EDISON ELECTRIC INSTITUTE BULLETIN

Courtesy, Westinghouse

VOLUME II MARCH 1934 NUMBER 3

STATISTICAL DATA OF THE ELECTRIC LIGHT AND POWER INDUSTRY

Compiled Monthly by the Edison Electric Institute—Covers 100% of the Industry

DURING THE MONTH OF JANUARY

	1934	1933	%
Kilowatt-hours Generated* (net)			
By fuel	4,340,916,000	3,716,098,000	+16.8
By water power	2,706,247,000	2,760,835,000	− 2.0
Total kilowatt-hours generated	7,047,163,000	6,476,933,000	+ 8.8
Additions to Supply			
Energy purchased from other sources	197,037,000	156,163,000	+26.2
Net International imports	69,120,000	29,012,000	+138.2
Total	266,157,000	185,175,000	+43.7
Deductions from Supply			
Energy used in electric railway departments	66,273,000	75,191,000	−11.9
Energy used in electric and other departments	115,889,000	106,020,000	+ 9.3
Total	182,162,000	181,211,000	+ 0.5
Total Energy for Distribution	**7,131,158,000**	**6,480,897,000**	**+10.0**
Energy Lost in Transmission, Distribution, etc.	**1,220,349,000**	**1,108,331,000**	**+10.1**
Kilowatt-hours Sold to Ultimate Consumers	**5,910,809,000**	**5,372,566,000**	**+10.0**
Sales to Ultimate Consumers (kw-hrs)			
Domestic Service	1,243,962,000	1,205,634,000	+ 3.2
Commercial—Small Light and Power (Retail)	1,162,345,000	1,120,762,000	+ 3.7
Commercial—Large Light and Power (Wholesale)	2,748,258,000	2,342,924,000	+17.3
Municipal Street Lighting	222,070,000	234,326,000	− 5.2
Railroads—Street and Interurban	396,054,000	360,586,000	+ 9.8
Railroads—Electrified Steam	61,517,000	48,879,000	+25.9
Municipal and Miscellaneous	76,603,000	59,455,000	+28.8
Total Sales to Ultimate Consumers	5,910,809,000	5,372,566,000	+10.0
Total Revenue from Ultimate Consumers	$162,070,400	$160,279,300	+ 1.1

DURING TWELVE MONTHS ENDING JANUARY 31st

Kilowatt-hours Generated* net			
By fuel	48,051,338,000	45,294,044,000	+ 6.1
By water power	31,536,558,000	30,880,557,000	+ 2.1
Total kilowatt-hours generated	79,587,896,000	76,174,601,000	+ 4.5
Purchased energy (net)	2,975,240,000	2,797,741,000	+ 6.3
Energy used in electric railway and other departments	1,903,374,000	2,061,069,000	− 7.7
Total energy for distribution	80,659,762,000	76,911,273,000	+ 4.9
Energy Lost in Transmission, Distribution, etc.	**14,367,911,000**	**13,661,937,000**	**+ 5.2**
Kilowatt-hours Sold to Ultimate Consumers	**66,291,851,000**	**63,249,336,000**	**+ 4.8**
Total revenue from ultimate consumers	$1,775,206,700	$1,817,885,600	− 2.3
Important Factors			
Per cent of energy generated by water power	39.7%	40.5%	
Average pounds of coal per kilowatt-hour	1.45#	1.49#	
Domestic Service (residential use)			
Average annual consumption per customer (kw-hr)	605	599	+ 1.0
Average revenue per kw-hr (cents)	5.48¢	5.58¢	− 1.8
Average monthly bill per domestic customer	$2.76	$2.79	− 1.1

BASIC INFORMATION AS OF JANUARY 31st

Generating Capacity (kw)—Steam	24,041,800	24,223,000	
—Water power	9,005,300	8,902,800	
—Internal Combustion	452,600	458,900	
Total generating capacity in kilowatts	33,499,700	33,584,700	
Number of Customers			
Farms in Eastern Area (Included with Domestic)	(505,545)	(502,985)	
Farms in Western Area (Included with Com'l—Large)	(204,997)	(203,321)	
Domestic Service	20,025,830	19,788,367	
Commercial—Small Light and Power	3,690,462	3,664,106	
Commercial—Large Light and Power	523,893	543,702	
All other ultimate consumers	66,929	69,933	
Total Ultimate Consumers	24,307,114	24,066,108	

*By courtesy of the U. S. Geological Survey with deductions for certain plants not considered Electric Light and Power Enterprises.

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EDISON ELECTRIC INSTITUTE BULLETIN

Volume II MARCH, 1934 No. 3

1934 CONVENTION PLANS NOW BEING DEVELOPED

To Be Held at Atlantic City, June 4-7

Preparations for the second annual convention of the Edison Electric Institute to be held at Atlantic City, June 4th to 7th inclusive, are now being made.

Convention headquarters will be at the Traymore Hotel, where arrangements have been concluded for the use of the Traymore's large auditorium for the general sessions of the convention and for several additional meeting rooms to accommodate committee and other special meetings.

Preliminary plans call for four general sessions; one to be held on Tuesday morning, Tuesday afternoon being reserved for committee meetings; one on Wednesday morning and one on Wednesday night; and the final session on Thursday morning, June 7th. The four general sessions will be open to attendance by all interested in the electric light and power industry. Monday, June 4, will be reserved for executive meetings of Institute members.

As was the case at the convention in Chicago last year, the program will be filled by speakers from within the industry and the subjects will include matters of pressing interest and importance to the electric light and power industry.

A modest recreational program is under consideration for this year's convention. It will probably consist of orchestra music for dancing on one evening, and entertainment for lady guests on one afternoon.

Negotiations with the railroad companies to secure reduced railroad fares to Atlantic City are now in progress, and members of the Institute will be provided in ample time with certificates to enable them to secure the advantage of the reduced rates. A list of hotels, giving information as to the character of accommodations offered, the range of prices and the location of hotels, will be published in an early issue of the BULLETIN.

A meeting of the Operating Committee to be held on March 21 will consider additional plans for the convention. The April and May issues of the BULLETIN will carry further information on the convention as it develops.

1933 ANNUAL DATA ON THE ELECTRIC LIGHT AND POWER INDUSTRY

Compiled by the Edison Electric Institute—Covers 100% of the Industry

	1933	1932	%
Kilowatt-hours Generated (Net)**			
By fuel	47,426,520,000	45,778,383,000	+ 3.6
By water power	31,591,146,000	31,106,865,000	+ 1.6
Total kilowatt-hours generated	79,017,666,000	76,885,248,000	+ 2.8
Additions to Supply			
Energy purchased from other sources	2,288,406,000	2,178,581,000	+ 5.0
Net International imports	605,852,000	440,884,000	+37.4
Total	2,894,258,000	2,619,465,000	+10.5
Deductions from Supply			
Energy used in electric railway departments	698,815,000	842,976,000	−17.1
Energy used in electric and other departments	1,203,608,000	1,219,625,000	− 1.3
Total	1,902,423,000	2,062,601,000	− 7.8
Total Energy for Distribution	**80,009,501,000**	**77,442,112,000**	**+ 3.3**
Energy Lost in Transmission, Distribution, etc.	**14,255,893,000**	**13,678,088,000**	**+ 4.2**
Kilowatt-hours Sold to Ultimate Consumers	**65,753,608,000**	**63,764,024,000**	**+ 3.1**
Number of Customers (Average for Year)*			
Domestic	19,800,172	19,955,545	− 0.8
Commercial—Small Light and Power (Retail)	3,671,102	3,707,452	.....
Commercial—Large Light and Power (Wholesale)	528,570	554,650	.....
Municipal Street Lighting	37,166	35,641	.....
Street and Interurban Railways	637	637	.....
Electrified Steam Railroads	27	27	.....
Municipal and Miscellaneous	29,379	28,471	.....
Total Number of Ultimate Consumers	24,067,053	24,282,423	− 0.9
Kilowatt-hours Sold to Ultimate Consumers			
Domestic Service	11,960,256,000	11,986,872,000	− 0.2
Commercial—Small Light and Power (Retail)	12,474,822,000	12,932,095,000	− 3.5
Commercial—Large Light and Power (Wholesale)	33,722,373,000	31,185,783,000	+ 8.1
Municipal Street Lighting	2,213,007,000	2,364,480,000	− 6.4
Street and Interurban Railways	4,003,876,000	4,175,022,000	− 4.1
Electrified Steam Railroads	661,387,000	539,901,000	+22.5
Municipal and Miscellaneous	717,887,000	579,871,000	+23.8
Total to Ultimate Consumers	65,753,608,000	63,764,024,000	+ 3.1
Revenue from Ultimate Consumers			
Domestic Service	$ 656,570,100	$ 669,1997,00	− 1.9
Commercial—Small Light and Power (Retail)	499,684,400	528,861,300	− 5.5
Commercial—Large Light and Power (Wholesale)	465,190,800	476,450,600	− 2.4
Municipal street lighting	94,269,500	100,918,700	− 6.6
Street and Interurban Railways	36,358,900	38,310,700	− 5.1
Electrified Steam Railroads	6,549,900	5,821,000	+12.5
Municipal and Miscellaneous	14,792,000	13,033,900	+13.5
Total from Ultimate Consumers	$1,773,415,600	$1,832,595,900	− 3.2

*Number of Customers on December 31st were as follows:

	1933	1932
Farms in Eastern Area (Included with Domestic)	(506,637)	(500,782)
Farms in Western Area (Included with Commercial—Large)	(204,005)	(204,293)
Domestic Service	20,006,129	19,849,963
Commercial—Small Light and Power	3,697,324	3,687,636
Commercial—Large Light and Power	525,625	544,689
All Other Ultimate Consumers	66,437	67,012
Total Ultimate Consumers	24,295,515	24,149,300

**By courtesy of the U. S. Geological Survey with deductions for certain plants not considered Electric Light and Power Enterprises.

NOTE: Data for 1932 and 1933 is subject to revision pending final 1932 U. S. Census releases.

A STATEMENT ON THE NEW YORK MUNICIPAL OWNERSHIP BILL

By FLOYD L. CARLISLE

Chairman of the Boards of Directors of Consolidated Gas Company of New York and Niagara Hudson Power Corporation

A statement at the Joint Hearing before the Committees on Public Service of the New York Senate and Assembly, State Capital, Albany, N. Y., Feb. 20th, 1934.

I am speaking on behalf of the New York City companies in the Consolidated Gas System and the Niagara Hudson companies. I do not conceive of any purpose of a public utility company except for the purpose of generating and selling electricity or service at as low a rate as is possible to do it. Any other conception, any other side issue, any other method of operation, in my judgment is wrong. And the companies with which I have to do are devoting themselves exclusively and totally to the simple problem of producing and selling electricity at the cheapest possible price.

OPPOSES PUBLIC OWNERSHIP BILL

I am not going to talk in detail on all of these bills; there will be briefs filed by our attorneys. I want to concentrate almost entirely on this public ownership bill. I would be completely betraying the people who have entrusted me with a position of responsibility in these companies, that represent an investment in dollars in the facilities used in the City of New York and upstate of slightly under two billion dollars, if I did not say to you, gentlemen, in my judgment competition by municipalities free from taxation would mean our complete and utter eventual ruin.

Last year the Consolidated Gas Company of New York paid in taxes $36,000,000—an increase from 1929 up from $25,000,000, 46 per cent increase. And that doesn't tell but part of the story, because the people who received dividends, who received bond interest, paid taxes upon their income; people that died owning these securities paid great inheritance taxes. I believe I am not exaggerating to say that the New York City companies, under the group of Consolidated Gas, are contributing annually $50,000,000 to the various governments that take taxes from them. Our competitor is to pay no taxes.

THIRTEEN KINDS OF TAXES PAID

Let me recite very briefly the character of taxes that we pay: We pay a tax on the real estate that we own. We pay special franchise taxes. We pay personal property taxes. We pay taxes on our checks. We pay on our gross earnings. We pay on our city excise. We pay on excess dividends. We pay on gross receipts. We pay on sales. We pay on income. We pay on franchises. We pay a capital stock tax, and, commencing Sept. 1, we started paying a three per cent electric sales tax—thirteen separate and distinct kinds of taxes paid.

Why, gentlemen, if municipalities have the right to engage in business in competition with us, without the payment of taxes, no company, regardless of its financial resources, could possibly thereby survive. It would be like tying a man's hands back of him and going out to fight a man with a shotgun in front of him. And what would be gained by this thing? Is it any social gain to the whole body politic to wipe out taxes and reduce rates their equivalent? Is anybody really helped? Somebody is getting his electricity at a slightly cheaper rate and every other house, property, business income must be taxed to make up that difference.

WHO ELSE WOULD PAY THESE TAXES?

Let us assume that the City of New York tomorrow entered into this business and we were out of it—where would the $50,000,000 be replaced in taxes that are now being paid? They certainly would not be paid by the municipality. They would have to be imposed upon other properties and other income. Why, gentlemen, if you want rates created by reason of absence from taxation, if you will change the laws of this state and this country, tomorrow morning we will reduce our rates the equivalent of that saving.

Now, there is no other saving possible except this further one of tax exempt securities. If the City of New York had an investment of $1,300,000,000 in the facilities that we have, instead of that property in their hands being subject to taxation, it would be in the hands of the very wealthy who buy tax exempt securities for the sole purpose of not paying the expenses of government. I cannot conceive of that being a social benefit.

I want to very briefly touch this fact: I hold in my hand a pamphlet containing the electric rates of all the municipalities in the state. Now, if it is necessary to pass a municipal ownership bill, certainly there ought to be something in experience to prove that it is going to mean something real. The top rate of a municipality in this state is 13 cents; the low top rate is 3½ cents; the average rate runs between 8 and 9 cents. Practically every rate schedule of a municipality has a dollar minimum bill, outside of the City of Jamestown, and I want to pause there for one moment.

THE CASE OF JAMESTOWN

Prior to the organization of the Niagara Hudson Company, of which I am Chairman of the Board, for years a battle occurred in Jamestown between the local company, now a part of Niagara Hudson, and the City of Jamestown. There was a fair test; they were dividing the business practically in half and the distinguished Chairman of the Public Service Commission, who sits here to my left, came to me and said, "That is not a wise thing in this state; why don't you buy or sell?" I said, "I agree with you, Mr. Chairman." Negotiations were conducted as honest businessmen would transact business with each other, and the result was that we sold our property to the City of Jamestown, and the City of Jamestown has gone without that foolish competition.

There is absolutely no municipality doing business in the State of New York today, including the City of Jamestown, that would sell power as cheaply as the upstate companies would sell it if they were freed from taxation.

COMPARISON WITH THE HYDRO OF ONTARIO

I want to say one other thing here, and say it with complete sincerity and with a backing that I mean what I say. What is apparently sought by this government ownership bill is to build up in

this state a system comparable to the Hydro-Electric Commission of Ontario. In what I say I am not criticising that commission. The companies with which I have to do have agreeable business relations with them. I know them and have the highest respect for their integrity and honesty and competency. It is the outstanding successful publicly-operated electric enterprise in the world. But the companies within the Niagara Hudson group deriving their power from Niagara Falls are selling 50 per cent more kilowatt hours of electric energy for the same money as the Hydro-Electric of Ontario. I will say this: That take away taxation, put us on a comparable basis and we will make lower domestic rates than the Hydro of Ontario and make more money than we make now.

I want to touch one other point. Upstate New York and New York City are now a great integrated source of power supply and transmission. The cheapest producing plant in New York State now is hooked up to the great steam plants on the New York City waterfront. Every economy that money, engineering and skill can give are represented by this plant that is here for service in the state. Is it conceivable that the state would arm municipalities with the absence from taxation to go out and destroy that machine? I cannot believe it. If it were in the interest of municipalities to go into the business, it would be in their interest to take over the existing property at its fair value. Any person who says that that would mean buying obsolete property, property not up to date, utterly ignores the term "fair value." If this provision cannot be written into these bills, there could only be one interpretation of the purpose of leaving them out, and that is to destroy the property by competition.

NRA PRINCIPLE AGAINST DUPLICATION

I happen to have spent most of the last six months in Washington working on the NRA. The National Industrial Recovery Act was the great declaration of the President of the United States and Congress to get business back prosperous in this country again, and to do that what did they do? They wrote into that great bill, which is the heart and forefront of the recovery program, this principle: That you shall not duplicate existing facilities in any industry in the United States, but you shall first use up that which you have.

What does this bill permit? Is it conceivable that in the City of New York another underground system of electric conduits could be built? The streets of New York are now crowded with water, steam, gas, telephone, and other wires. Is it possible that we have passed to such a low state of intelligence in this state that we are going to duplicate the overhead transmission lines in our northern cities—and yet that is what this bill permits.

In common fairness, common sense, business prudence, if the people of this state are ready to go to the principle of government ownership, I say to them the cheapest thing they could do would be to honestly face the question and take over the existing properties. Now, it must be, if the tremendous change is to be urged, that something has been terribly wrong with the rates in this state.

Gentlemen, I take some pride in this fact: The companies with which I have to do sell better than 75 per cent of the electricity in this state. That is more than is used in all Italy, more than in Switzerland, one and one-half times as much as in Sweden. New York State itself used last year 80 per cent as much power as all Great Britain and Germany. Now, if we were engaged in a business that was inflicting punishment upon the people of this state, how under Heaven's name has it been that in this state the greatest use of electricity anywhere in the world exists?

Men can honestly differ on regulation, and men can honestly present different theories of rate making, but I can't see any conceivable honest difference on the proposition that the destruction of this business through the ability to be free from taxation is fair or presents in any man's mind an honest attitude.

5% RETURN WOULD CURB EXPANSION

In concluding I just want to make reference to this temporary rate bill. I don't know why five per cent is written in the bill. It must be for some reason. I just venture the thought that if that bill were passed in that form every person wanting to annoy or harass the Public Service Commission would point his finger to the fact that there is your five per cent. Why don't you make them take it? The New York Edison Company has got outstanding six and one-half per cent non-callable bonds that were issued in 1920 and 1921. Hardly an upstate company exists without seven per cent non-callable bonds that have many years yet to run. They were necessary to get money at that time.

Remember this, gentlemen: We are in a business where we can't take or leave business. Under the laws of this state any householder and any manufacturer can demand service from us.

When we took our charters and were incorporated under the laws of this state, we took upon ourselves the duty of performing this service.

This state has increased in population at the rate of 500,000 people a year; New York City has increased at the rate of 300,000 per year. We have to provide facilities annually for a city the size of Rochester, New York, every year, and we have to go out in the money markets and get our capital, based upon our earnings, what other capital is commanding, and what not. We have no choice in that. It is a bill that, if we even squinted at five per cent interest, would prevent these companies from commanding any capital at all.

We have in New York City normally six or seven thousand men working on construction. They are out now. There is no construction going on. There is practically no construction going on in any utility in this state except that of the barest necessities. If you pass these bills, there won't be any for the next five or six years.

Gentlemen, I speak as one entrusted with responsibility and I have made no exaggeration.

Depreciation

A Review of Legal and Accounting Problems

This report prepared by the Staff of the Wisconsin Public Service Commission at the request of the National Association of Railroad and Utilities Commissioners, covers the whole subject of depreciation but emphasizes primarily "straight Line" depreciation.

Included in the report are sections on:

Depreciation Problems Presented to Regulatory Commissions
Meaning of Depreciation
The Accounting of Depreciation
Depreciation as a Factor in Valuation
Legal Doctrines of Depreciation
Case for Deduction of Depreciation Reserve
Correction of Depreciation Reserves
Methods of Estimating Service Life
Methods of Estimating the Depreciation Reserve Requirement

The book is published by the State Law Reporting Company, New York, N. Y., Official Publishers of the National Association of Railroad and Utilities Commissioners, 200 pages, price $1.85 (cloth) plus postage.

A MERCHANDISING PROGRAM TO MEET PRESENT-DAY CONDITIONS

By GEO. E. WHITWELL

Chairman, Sales Committee, Edison Electric Institute and Vice-President in Charge of Sales, Philadelphia Electric Company

An address before the Mid-Winter Sales Conference of the Pennsylvania Electric Association, Pittsburgh, Penna., Feb. 27, 1934

The popular impression of the man in the street today is that he is paying exorbitant rates for the electricity supplied to his house or small place of business. Practically every publicity medium has contributed to the strengthening of this impression and, as you well know, many governmental agencies have been active in confirming the average citizen's idea of the rapaciousness of his electric company.

The electric power industry is singularly open to such misconceptions. It is a monopoly in a certain sense, although not free from direct competition, nor free from the competition in the great race for the purchaser's dollar. Whether actively engaged in the actual selling or not, each utility company quite naturally is interested in having as many as possible of these dollars go into the purchase of appliances, lighting and commercial equipment. Its interest lies in the use of electricity but there is unlimited competition in the form of other needs which the customer desires to satisfy. Not everyone feels the necessity for electrical devices that you and I believe he should —a new suit or a new dress may seem of much more vital importance than several table appliances that would make breakfast easier and more attractive or a new vacuum cleaner that will do a really thorough cleaning job when the old carpet sweeper and broom seem to take up the worst of the dirt. Similarly with the commercial user. This is competition of the severest type. Without an increase in the use of appliances, lighting and equipment, consumption per customer will not increase.

Somehow or other electricity use per domestic and small commercial customer must be increased. Only in this way can rates be decreased and, at the same time, revenue obtained to meet the increased expenses that are due to operation under the N.R.A. and to increased taxes and that will materially affect net revenues in the years ahead. I hardly need to point out to you what a great increase in taxes, labor and material has already resulted from recovery measures. It is perhaps not out of order to consider, in addition, what the thirty hour week, for example, would mean. In my own company we are at present working forty hours per week. Consider that a reduction from forty to thirty hours per week is a reduction of twenty-five per cent, and assuming that we would not be permitted to reduce compensation accordingly, then in order to obtain the same man-hours per week as at present, a thirty-three per cent increase in cost would be necessary.

The problem is real. It may become even more serious. Your speeches and mine of previous years that called for greater residential and commercial revenues were the result of necessity that pales almost into insignificance in the light of today's urgency.

In a recent address, Mr. J. E. Zimmermann, President, The United Gas Improvement Company, pointed out:—

"Title I of the National Industrial Recovery Act, states:

"'It is hereby declared to be the policy of Congress . . . to eliminate unfair competitive practices, to promote the fullest possible utilization of the present productive capacity of industries.' You are all familiar with the manner in which these principles are being applied by Codes to the various branches of industry.

"However, as applied to the electric industry it appears that these clauses mean nothing. On the one hand, we find the Federal government providing funds to build large hydro-electric plants to enter into direct competition with private companies.

"On the other hand, we have the spectacle of the Public Works Administrator offering funds to municipalities with which to establish competing plants, upon terms which are in effect nothing less than subsidies."

Electric power companies face the paradox of demands for more widespread use of electricity coincident with the imposition of greatly increased costs, taxes, and governmentally imposed competition, and with concerted efforts for the attainment of lower rates. The public utility industry wants soundly lowered rates as much as anyone else. But its critics shout from the house-tops for reductions in rates for the benefit of the people, then gather in solemn assembly to pass legislation which will tax it and offer it competition to the point where rate reductions not only may become impossible, but increases may become necessary. Even the goose that lays the golden egg of taxes paid may have to go off the gold standard.

I know of times in the past three years when my own company has had rate reductions under consideration for periods varying from six months to eighteen months before they became effective, for no other reason than that some new tax bill or measure was under discussion by State or Federal bodies. It would have been folly on our part to have proceeded with a cut in rates until the impending legislation was settled or until at least we had some definite idea of how far-reaching its effect would be.

We in this group are vitally interested in the question of taxation, not only because of our industry but also as individuals, for it affects our own pocketbooks. More people have a direct interest in the tax burden of the utilities than in that of any other single industry in the United States, not excepting farming. Twenty million homes and four million business establishments of all kinds are customers of the utilities of this country, and vitally interested in maintenance of adequate, low cost service. Bonds and stocks of utility companies are held by insurance companies, trust and savings banks, as well as colleges and universities, to which institutions the savings and cultural interests of millions of citizens are entrusted. Yet in the imposition of taxes within the past two years, these same utilities have suffered more discrimination than has any other major industry in the United States, and this discrimination can well reflect itself directly or, for example, through life insurance policies to the personal financial disadvantage of millions of citizens.

Is it entirely proper that an industry which, by and large, has done a good job, should be taxed and burdened beyond

its proper share of the obligation that it willingly assumes in bringing our nation back along the road to business recovery?

At the present time, one-third of the national income is required for taxes; this, remember, is an increase in one generation from one-twelfth. I do not need to remind you that the present activities of the Federal Government have to be paid for. Whether you agree with them or not, whether you feel that under the circumstances such policies offer the only humane and economically sound solution to a mighty serious problem, someone will have to pay for them. And that someone is collectively you and I, along with the rest of the forty-nine million income-producing individuals. Taxes and the repayment of Government debt can come only from profits —personal or corporate.

Of the total tax bill of the company which I represent, 64.3 per cent goes to the Federal Government, while State taxes take 25.1 per cent of the total. The balance goes to county and municipal taxes. Figures prepared during the past year by the Edison Electric Institute show that, nationally, 14 cents out of each consumer's dollar spent for electrical energy was in payment of the tax bill. And this will be increased during 1934 with the first full year of the imposition on the utility of the 3 per cent tax on residential and commercial consumption of electricity.

From 1929 to 1933, the tax bill of electric utilities rose from $187,500,000 to $250,000,000, while gross revenues declined by well over $180,000,000. Note that the decline in revenue in four years nearly equals the total tax bill for the year 1929.

Domestic customers in Philadelphia pay an average of $2.78 per month for electric service, which is 9 cents per day. I doubt if those who criticize utilities and who will spend some of its tax money to pay for "yardsticks" for the "protection" of the domestic customer ever call to attention the fact that the contribution per American home for the support of Government is at least $1.30 per day, or fourteen times the amount paid for all the many invaluable services rendered by electricity. A reduction in these taxes of 7 per cent would pay the residential light bill.

There can be no doubt but that the Federal Government, directly and through P.W.A. aid to municipalities, has embarked upon a program for the development and building of Government owned and operated electric power systems which, it is said, are to be used as yardsticks by which the fairness of privately owned utility residence rates is to be measured. Fundamentally, those Government projects about which there is at present any authentic information, are to start with residence rates which (admittedly) will provide, at the beginning of operations, only a small portion of the revenue required to meet expenses. It is stated, however, that initial low residence rates will bring such rapid load-building that a profitable degree of use will be attained. Until such attainment of profit, these Government undertakings will of necessity be subsidized.

In order to hasten the rate of load-building, the Government proposes rapid distribution of electrical appliances (primarily the range, refrigerator, water heater and certain farm devices) which will be very low in price and offered on credit terms which will be liberal beyond anything heretofore contemplated by appliance manufacturers, distributors, dealers, utilities or financing concerns. It would be of little avail to detail here all of the difficulties which will have to be overcome in accomplishing this load-building in territories, for example, like that of the Tennessee Valley Authority. Suffice it to say that if the cost is not counted, residential load can be built by these Government agencies.

Privately owned and operated utilities can lower residence rates materially only as load is built sufficiently to warrant reductions. We cannot, like the Government, establish highly unprofitable, low residential rates that it is hoped some day will be profitable when adequate consumption has been obtained. We have no almost limitless source of money—for example, taxation—upon which to draw to offset the loss that would be entailed through a process of cutting rates to a point which would induce sufficient consumption to produce profit only after an unknown number of years. Yet, today's residence rates in my own company, including that for water heating, permit a cost per kilowatt-hour decidedly comparable with the cost which would result from the announced rates of the Tennessee Valley Authority, provided full use consumptions could be actually made to exist both in the territory of the Philadelphia Electric Company and in that of the Tennessee Valley Authority.

We, therefore, feel that we can withstand successfully comparisons with Governmental yardsticks of average residence rates provided we can build load as fast as, or faster than, the Tennessee Valley Authority. In order to build up this average residence consumption, emphasis must be laid upon the sale of the three major electric load-building appliances, namely, the refrigerator, the range and the water heater. It should be noted in passing, however, that the refrigerator alone will not produce the desired result. It follows, therefore, that there must be a reasonably rapid saturation of ranges and water heaters.

Not only must we secure a reasonably rapid saturation of the major appliances, but we must make every effort to induce customers to continue the use of appliances already purchased but perhaps out of service due to the need for some minor repair. This is more of a problem than many of us think. We promote appliances, we do everything to foster their acceptance and use, but, with the exception of the major appliances which presumably will be used due to the amount invested in them by the customer, do we know that the electric iron, toaster, grill, waffle iron, vacuum cleaner, washer and the host of other smaller appliances are in regular use? How many times has each of us carried a letter in his pocket for days without mailing it? Too many times to even count. Therefore, isn't it reasonable to expect that a large number of appliances are out of service waiting for the combination of circumstances which will inspire the owners to make the effort to have them repaired?

I believe we take too much for granted. Lamp campaigns have definitely proved this point many times. Why not consider appliance repair campaigns or a system whereby the meter reader leaves a reminder that appliance repairs will be made by the company or the local electrician, as the case may be? The methods of doing this are endless. I suggest them merely to make sure that we leave no stone unturned, for in building up average use through new load-building devices, it is now more important than ever before, that, knowingly, we do not lose that which we have already gained.

There is one other phase of the problem, however, that does not deal with average residence rates, but deals with the top step or block in the residence rate. It is desirable, if not necessary, to reduce the top block simultaneously with the reduction in average cost. At present the top block in the residence rates of the Tennessee Valley Authority calls for three cents per kilowatt-hour, with a

minimum. This is appreciably lower than the top block in the residence rates of practically all electric utility companies in the United States. It is not conceivable that a top block of three cents produces even the operating expenses of serving the small use residence customer. In fact, in the case of the Philadelphia Electric Company, with a minimum charge of seventy-five cents, which includes the use of ten kilowatt-hours, and with a second block of five and a half cents, 47 per cent of all residence customers do not pay their fair share of operating expenses plus a return of seven per cent on the investment allocated to serve them, and fourteen per cent of all residence customers do not use enough electricity to pay the operating expense created by them. If top blocks are to be cut, only two paths are open:

(1) To arbitrarily cut them, thereby increasing the unprofitableness of half of our residence customers, with such deficits made up by the larger use or profitable customers (generally those to whom manufacturers, jobbers and dealers must naturally sell lighting, refrigerators, oil burners, washers, cleaners, ranges and water heaters) or—

(2) To attempt to increase the use of these unprofitable customers through the sale to them of relatively low-priced small heating and lighting devices which will increase the consumption per year of each of these unprofitable customers by perhaps 100 to 200 kilowatt-hours.

The first of these paths is distinctly unbusiness-like and is unfair to the user of profitable quantities of electricity and to the dealers, jobbers and manufacturers who should not be unnecessarily handicapped in the selling of equipment to the profitable electricity user. The second of these paths is worth attempting to follow, although conceivably it can only be followed if the electrical industry agrees that it is in its own best interests to inaugurate certain merchandising practices which, in the past, have been considered undesirable and unnecessary.

Presumably, a very large percentage of the 240,000 unprofitable electric customers of my own company are people of extremely limited incomes. It would appear, therefore, that by and large, appliances of low selling price—for example, $5.00 or under—but with fairly high annual consumption of electricity —for example, 100 to 200 kilowatt-hours—should be sold to this group of customers by some sort of a local industry mass selling program which would offer to the dealer, as nearly as may be, the same advantages as those which the utility would have in its own mass selling program.

Therefore, to attempt to solve this problem of meeting Government yardsticks for rates, of paying the tax bills which will fall to our lot and of taking care of additional expenses resulting from the National Industrial Recovery Act, I propose a five-point residential sales program, each point of which is independent of the others — all five points, however, to be carried on simultaneously if maximum results are to be obtained.

Point No. 1—Electric Refrigerators

The present situation in my own territory with respect to the sale of electric refrigerators is very satisfactory. Final figures for 1933 show that 47,100 domestic electric refrigerators were connected to our lines during 1933. This number, expressed as a percentage of the number of residence customers, is materially above the average performance for the United States as a whole; yet, even with these known sales of refrigerators and with the sales of all other appliances, the average annual kilowatt-hours of consumption per domestic customer of the Philadelphia Electric Company increased only 18 in 1933, as compared with 1932, whereas the consumption from these refrigerators alone, assuming no replacements, should have produced more than twice this result. It, therefore, follows that sharp losses were experienced in connection with other residence uses for electricity during the time that these refrigerators were being added to the system.

Theoretically, about 56,500 refrigerators (over and above replacements) added to the system would produce enough revenue to compensate for a reduction, in the second block of the residence rate of the Philadelphia Electric Company, of ½ cent or from 5½ to 5 cents per kwhr. The net addition of 76,000 more refrigerators would compensate for a reduction in the second block of from 5 to 4½ cents. Such compensation, however, would occur only if none of these refrigerators were replacements and if there was no tendency on the part of the new users of refrigerators to make up, by curtailment of other residential electricity uses, for the increase in electricity use due to the operation of the refrigerator. There is no assurance that this number of refrigerators can be sold, even in part, to our present unprofitable residence customers. The sale of the first 56,500 refrigerators would have to be generally to those having incomes of from $2700 to $3500 per year, and the additional 76,000 would have to be sold to those having incomes of from $2100 to $2700 per year.

It is therefore seen that while the refrigerator is a very necessary device in any sales program, it alone can bring only a partial solution to the present sales problem. Our own territory is well organized to do a good job on electric refrigerators. Their sale will be aggressively promoted by the Electrical Association of Philadelphia, by the utility company, and by the large and substantial manufacturers' agencies which are successfully doing business in the Philadelphia area. The importance of the sale of electric refrigeration warrants its being given first place in this five-point selling program.

Point No. 2—Electric Ranges

The electric range is absolutely essential in connection with any program that is to rapidly build the average consumption of the residence user. It probably is of little or no value in reducing the number of unprofitable residence consumers. When, however, the problem becomes one of increasing, by three or four times, the present average annual residence consumption per customer, which in Philadelphia is 645 kilowatt-hours, the 1500 kilowatt-hours used annually by an average electric cooking customer cannot be anything but an absolute essential in the load-building activity. It is significant that the range is one of the three home devices that will be promoted aggressively by the T.V.A.

The electric range has some acceptance in the territory of the Philadelphia Electric Company. It is doubtful, however, if there are even yet more than 10,000 of them in regular use. The sale of the range is attended by difficulties, not the least of which are the price of the range and the servicing problems and costs which have been experienced in the past. Nevertheless, a four burner, 16-inch-oven range is available this year which can be retailed, after a full merchandising mark-up, for less than $100.00, and which appears to be subject to fewer servicing difficulties than those which have been experienced heretofore. Most important of all, there are in rapid development certain radical changes in connection with electric range design and construction that should in the very near future result in still lower prices and still more favorable operation.

There has, therefore, been prepared as Point No. 2 for Philadelphia a comprehensive local industry electric range selling campaign. It is not too much

to hope that this campaign will result in the addition to our connected residence load of somewhere around 5,000 ranges. Such a number of ranges would produce a consumption of about 7,500,000 kilowatt-hours per year. Each 350 ranges would increase the kilowatt-hour consumption per domestic customer by one kilowatt-hour.

Point No. 3—Electric Water Heaters

Without question, the most rapid load-builder among today's tried electrical appliances is the water heater. A water heater will average about 4,000 kilowatt-hours per year. Each 130 put on the lines of the Philadelphia Electric Company will increase the annual average consumption per residence customer by 1 kilowatt-hour.

While there are not many electric water heaters on our lines, experience in this appliance during the last two years indicates that it gives satisfactory performance at a cost reasonably comparable with that of competitive devices. It is completely automatic, almost entirely trouble-free, and from an electric point of view constitutes the most desirable appliance that can be sold, provided only that coincident with its sale, sufficient other residence devices are sold and used so that the off-peak rate, with its present degree of profit, can be retained for water-heating.

The electric water heater will not tend to make profitable any customers now unprofitable; it can be sold only where income is sufficient to pay for the device, plus about $40.00 a year average for its use. Its market can be materially widened, however, through the adoption of a rental or trial installation plan.

Point No. 4—Small Appliances

Negotiations are now under way with the other branches of the Philadelphia electrical industry looking toward the adoption of some sort of mass selling of small heating and lighting appliances to the present unprofitable residence customers. Examples of such appliances are the non-automatic iron, the percolator, the non-automatic toaster, the cord set and the Pin-It-Up type of lamp. A card record is now being made of the name and address of each of the 240,000 present unprofitable residence customers. A proposal under which these customers would be sold small heating and lighting appliances under extremely liberal credit terms, by a special crew of Philadelphia Electric Company men, has been presented to the dealers. Under this plan, the dealers would be offered financing by us on the same basis that we are offering such financing to our customers —this dealer financing to be limited each month to a single featured item. The manufacturers and dealers had certain objections to offer in connection with the plan and are now preparing a counter-proposal for our consideration. A program of this character will, of course, not do a great deal to increase average residential consumption per customer per year, but, by reducing the number of unprofitable residence customers, should go toward making possible a succession of reductions in either the pricing of, or number of kilowatt-hours in, the second block in our residential rate.

Point No. 5—Miscellaneous Electric Merchandising

No selling program, to provide a solution to the problem as stated, could be complete unless it contemplated continuous and aggressive selling and continuing use of lighting, Mazda lamps, air conditioning and the other electrical appliances not elsewhere mentioned in this five-point program. Therefore, to round out the selling plan for 1934, Point No. 5 represents the continued merchandising by the Philadelphia Electric Company, with due regard to proper dealer cooperation, of those other devices —for example, Mazda lamps, washers, cleaners, ironers, air-conditioning and portable lamps — without the use of which, no home can become completely electrical and completely conversant with the comforts, conveniences and low cost of electrical service.

The smaller class of merchants, restaurants, lunch counter operators and others are a group of customers deserving of equal consideration with residential consumers.

In most companies, the small commercial group represents a relatively large number of individual customers and a very great variety of possible applications for electricity. For this reason, careful study should be given to determine the principal uses of electricity for this class of customer as a whole, so that these may be made the basis of special campaign activities which may be conducted with reasonable chance of success. While the salesman contacting this type of customer should be generally familiar with all of the principal applications applying to this customer group, we in the Philadelphia Electric Company have found it most advantageous to concentrate the salesman's attention on one or two applications at a time, rather than continually trying to promote a great number of applications. However, in order that each individual customer may receive the attention he deserves, we have prepared for our salesmen survey cards and handbooks. These survey cards list some 100 principal applications of electricity to commercial use and the handbook goes further in actually illustrating and giving descriptive information on some of the more important of these uses. The handbook has proven particularly helpful in giving the salesman something to put down before the customer during his sales talk in order to illustrate just what other customers of similar type are doing to promote their business or decrease their expenses by the greater use of electric service.

There is also a necessity for selection in determining those customers on whom the salesmen's efforts should be concentrated. In the Philadelphia Electric Company, for example, there are approximately 105,000 customers in the group intended to be covered by this discussion. Under present conditions we have deemed it advisable to automatically eliminate some 30,000 of these customers located in the poorer districts and for these 30,000 customers we have not yet even secured survey cards. For the balance of the customers, however, survey cards have been obtained and these are being covered by our salesmen as rapidly as our present man-power will permit.

As the salesman uses the survey card in making the original contact with the customer, he is instructed to determine from observation and conversation with the customer the following facts:

1. Whether the customer is now or probably will be within a period of six months, a prospect for additional electrical applications,
2. Whether the customer is apparently in a financial position to purchase additional equipment, and—
3. Whether or not the customer can, in the opinion of the salesman, use such additional equipment and thereby either increase his business or reduce his operating costs.

The results of the survey so far indicate that approximately one out of ten of those customers contacted are in a class which should be considered worthy of further cultivation, and, therefore, appear to be potential prospects. This does not mean that these customers are now willing or ready to purchase additional equipment or that they have definitely expressed a desire to do so. It does mean, however, that they are in a reasonably good financial condition and that, in the

opinion of the salesman, there are certain additional ways in which they could use electricity to their own advantage.

These selected customer cards are being placed in a separate file and are primarily the basis of mailing lists which are made up from time to time in connection with special campaigns.

In promoting the use of electric service among those customers who are in the selected group, we have found the use of the direct-mail campaign to be quite effective. Up to the present time, campaigns have been run on the following items:

(a) Store Lighting
(b) Electric Ventilating Equipment
(c) Outdoor Lighting
(d) Industrial Lighting
(e) Portable Electric Cooking Equipment
(f) Window Lighting
(g) Plans are now in the making for our campaign on Air Conditioning Equipment to start March 15.

In our special campaigns we believe we have been fortunate in the cooperation secured from the manufacturers of the equipment concerned. Prospects secured have been forwarded in rotation to points of contact designated by the cooperating manufacturers. These points of contact have included kitchen supply houses, electrical wholesalers and dealers, and manufacturers' representatives. These agencies actually sell the equipment to the customer.

In addition to the organized campaigns which have been held from time to time, we have endeavored to provide our salesmen with all necessary sales helps, including catalogues of the major items of equipment used by, and useful for, smaller commercial customers, salesmen's handbooks, and sales meetings which have been held in preparation for all of our major campaigns. At the present time we are holding a series of evening meetings in order to make sure that all of our salesmen are fully informed on some of the fundamental economics of air-conditioning.

To summarize the activities for increasing the use of electricity by smaller commercial customers, I believe it can be briefly stated that the work divides itself into three major classifications:

1.—A determination of the market to be worked.
2.—A survey of this market to determine those customers who are worthy of intensive sales cultivation, and—
3.—Selling the selected customers on the basis of campaign activities and personal follow-up.

And so, by a long and circuitous route, I have come to the end of a proposal for meeting a very real problem now facing all electric power companies. Perhaps I might have saved a great deal of time had I stated simply that sales of electricity to residence and small commercial customers must be increased by two or three times.

But perhaps it is just as well to have pointed out exactly what the problem is—namely, a situation where already greatly increased and continually increasing taxes, together with materially enlarged operating expenses resulting from the National Recovery Act, will have to be paid by electric utility companies at the same time that Government yardsticks, regardless of whether they are fairly competitive or not, will bring upon these companies the necessity for lower average rates in order to induce more widespread use of electricity by residence and small commercial customers. I can see no need, particularly, for bewailing the imposition of this problem. Perhaps it has been a blessing in disguise, if because of the unsoundness and injustice of the attack, the electric utility industry can obtain a much greater unity of constructive thought and action. Certainly it has been a blessing if it spurs us, who are charged with the sale of electricity, into the formulation, each for his own territory, of sound plans which, creating greater sales, will permit us to meet the problem.

I believe that the problem can and will be solved. It can be demonstrated, for any territory, first, that a surprisingly small saturation of ranges and water heaters—even though this saturation may seem large in comparison with that which has heretofore been obtained by most electric companies—will lick the problem of average consumption and average rates; second, that the electric refrigerator, as an established, growing and revenue-producing device, must and will do its part; third, that the problem of the unprofitable residence customer can be solved, in part at least, by aggressive attention being paid to the small heating and lighting device; fourth, that there can be no let-up in our orderly, planned and comprehensive attack upon the market offered for the use of miscellaneous equipment and lighting by both residence and small commercial customers; and, fifth, that there must be unremitting attention paid to the proposition of continuing in use those appliances, lighting installations and commercial devices which have in the past already been added to the lines of the electric power industry.

Perhaps those phases of the New Deal which have momentarily stunned us because of their discrimination against the electric power industry are really silver linings to the clouds of business depression. I present them to you as challenges to your ability to overcome them. I commend to you the formulation, for your property, of a comprehensive plan for a number of years, which, founded on the rock of sound economic justification and developed because of the necessities presented by competition, fair and unfair, and by increased expenses entirely beyond our control, can, without question, produce the revenues required to "out-yardstick" today's yardsticks.

Meeting Called to Amend E.E.I. Constitution

A special meeting to be held March 22 at New York has been called by President Cortelyou for action upon a proposed amendment to the Constitution of the Edison Electric Institute. The following letter was sent to all members on Feb. 16, by Mr. Cortelyou:

"Pursuant to Article XI of the Constitution of the Edison Electric Institute, the Board of Trustees of the Institute has approved, and recommends for adoption by the Institute, an amendment to the Constitution of the Institute as follows:

"By adding to Article III of the Constitution a new section, to read and provide as follows:

"Section 6: Until July 1, 1935, the Institute shall elect to membership any Company applicant who is otherwise eligible and who agrees in writing to comply with the provisions of Article IV hereof; and during such period, expulsion from membership shall take place only for violation of Article IV hereof."

"This amendment has been drafted and recommended in view of the interpretation placed upon provisions of the National Industrial Recovery Act. Approval by a two-thirds vote of the Company members present at such special meeting is required by the Constitution of the Institute.

"Pursuant to Article X of the Constitution of the Institute, a special meeting of the Institute has been called by the Board of Trustees, for the purpose of acting upon the above recommended amendment to the Constitution of the Institute and for the purpose of transacting such other and further business as may come before such meeting.

"The special meeting will be held in the Board Room on the 22nd floor at No. 20 Pine Street, New York City, on March 22, 1934, at 10:15 a. m. Your attendance is requested."

RECORD YEAR IS FORECAST FOR ELECTRIC REFRIGERATION

Bureau Figures Show Industry Is Off to a Flying Start With 35,212 Unit Sales in January—Field Manager is on Coast to Coast Trip Including 40 Cities—Interest in Spring Shows

With a total of 35,212 household electric refrigerators sold in the United States in the month of January, the electric refrigeration industry is off to a flying start in 1934. This figure is based upon the reports of actual sales received from 16 manufacturers, whereas last year only 12 were reporting.

The January total compares with 18,755 units sold in January of last year and 35,834 sold in December, 1933. With sales for the month almost double those of the corresponding month a year ago, and practically equal to those of December, which month usually tops January by a considerable margin, all indications point to another banner year for electric refrigeration. In fact, all manufacturers who have expressed an opinion believe that sales this year will be far in excess of last year's.

In setting up the quota for this year the Electric Refrigeration Bureau has taken approximately 5 per cent of the domestic meters as its sales goal. This means a total of 1,010,506 units, compared with 802,170, which was the quota for 1933. This latter figure represented 4 per cent of the number of domestic meters as of January 1 of that year.

In analyzing the sales report for January it is noted that the percentage of realization of national quota was 87.1, and that three divisions exceeded 100 per cent. These divisions, their standings and their Regional Directors are:

Eastern Division, F. W. Smith, Regional Director, 103.4 per cent; Southwestern Division, J. F. Owens, Regional Director, 107 per cent; Rocky Mountain Division, Arthur Prager, Regional Director, 120.4 per cent.

ALLISON ON WESTERN TRIP

After spending a few days in New England, during which time electric refrigeration dealer meetings were held in Boston and Providence, Dr. G. W. Allison, Field Manager of the Bureau, left early this month for St. Louis and points west.

The Northwestern Electric Light & Power Association held a meeting in Seattle on March 8 and 9, and Dr. Allison appeared on the program to discuss

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ELECTRIC REFRIGERATION BUREAU
SALES—HOUSEHOLD MODELS ONLY—FIRST MONTH 1934

	YEARS QUOTA	FIRST MONTH QUOTA—4%	ESTIMATED TOTAL SALES	% QUOTA REALIZATION
New England Division				
Connecticut	19,243	770	498	64.6
Maine	7,899	316	213	67.4
Massachusetts	49,224	1,969	1,320	67.0
New Hampshire	5,095	204	93	45.5
Rhode Island	8,074	323	337	104.3
Vermont	3,305	132	79	59.8
Eastern Division				
Delaware	2,054	82	75	91.4
Maryland & D. C.	20,319	813	793	97.5
New Jersey	49,202	1,968	1,755	89.1
New York	154,788	6,192	7,326	118.3
Pennsylvania	86,678	3,467	3,000	86.5
East Central Division				
Kentucky	11,293	452	502	111.0
Ohio	64,710	2,588	2,232	86.2
West Virginia	7,970	319	383	120.0
Middle West Division				
Iowa	19,012	760	431	56.7
Kansas	14,127	565	329	58.2
Missouri	27,824	1,113	1,345	120.8
Nebraska	9,783	391	379	96.9
Pacific Coast Division				
Arizona	2,916	117	110	94.0
California	78,695	3,148	1,497	47.5
Nevada	714	29	15	51.7
Northwest Division				
Idaho	3,303	132	48	36.3
Montana	3,550	142	33	23.2
Oregon	10,010	400	387	96.7
Utah	4,863	195	79	40.5
Washington	18,025	721	414	57.4
Southeastern Division				
Alabama	7,187	287	144	50.1
Florida	9,790	392	250	63.7
Georgia	8,309	332	302	90.9
North Carolina	10,945	438	364	83.1
South Carolina	4,358	174	265	152.2
Tennessee	9,783	391	342	87.4
Virginia	11,031	442	404	91.4
Great Lakes Division				
Illinois	77,150	3,086	2,440	79.0
Indiana	28,271	1,131	919	81.2
Michigan	44,387	1,775	1,736	97.8
Wisconsin	26,180	1,047	808	77.1
North Central Division				
Minnesota	19,794	792	527	66.5
North Dakota	2,511	100	56	56.0
South Dakota	3,217	129	143	110.8
Rocky Mountain Division				
Colorado	8,420	337	435	129.0
New Mexico	1,388	55	64	116.3
Wyoming	1,311	52	36	69.2
Southwestern Division				
Arkansas	4,554	182	194	106.5
Louisiana	8,242	330	163	49.3
Mississippi	3,568	143	86	60.1
Oklahoma	10,531	421	443	105.2
Texas	26,903	1,076	1,418	131.7
Totals	1,010,506	40,420	35,212	87.1

"MUNY" AND THE FARMER

By LEON O. WHITSELL

Commissioner, California State Railroad Commission

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Municipal ownership is an ever-present issue in California. The movement has, within recent times, assumed State-wide proportions and if carried to its logical conclusion bids fair to place this State in the forefront as America's leading municipal-ownership commonwealth.

In this movement I sense danger ahead. I believe that divorcing the city load from our great utility systems points a downward path to the social and economic life of rural California. I believe that this trend will eventually prove harmful to both city and rural sections.

The movement at the present time is very definitely directed against the electrical utilities and has for its intended purpose the taking over by the municipalities of distribution facilities within their corporate limits. This "splitting up" of system loads into elementary parts is, in my humble opinion, anti-social, a step backward—a direct reversal of the processes by which the almost universal use of electrical energy in modern social and industrial life has been accomplished.

I am not seeking controversy with the advocates of municipal ownership, nor do I wish to be understood as arguing the merit or demerits of municipal ownership per se. I merely seek to point out what I conceive to be the ultimate danger which threatens our rural people and the resultant harm which will be visited upon our city dwellers if this present intensified movement gains further momentum and the evident intention of its proponents is fully consummated.

Agriculture is California's basic industry and, therefore, of primary importance. It is the Alpha and Omega of our very prosperity. Agriculture is also the determining factor not only in our general economic well-being, but particularly in the prosperity of our urban classes. It has a purchasing power per capita far in excess of the average for the rest of our population. It supplies the raw materials upon which depends industry and directly and indirectly gives employment to over one-half of our city workers.

Agriculture supplies over one-fifth of the total tonnage of freight carried by our transportation systems. It pays over one-fifth of our total cost of government. It represents one-third of our State's tangible wealth and contributes one-third of our State income.

The cost of service in areas where consumers are closely grouped, as in our cities, is less than in rural areas where they are more widely separated. In the cities, both consumers and revenue per mile of line or per dollar of investment are much greater than in the country. Also, when a city takes over a distribution system, it generally purchases its power at wholesale rates which are based on the costs of serving a highly diversified combination of urban and rural loads. These rates give a wide margin of spread between the cost to the city and the rate to the ultimate consumer, its additional costs being limited largely to distribution expenses. Much of the overhead cost of operation is shifted to agencies already in existence functioning as city government. It pays no city, franchise, State or Federal taxes, which, for California electrical utilities, amount to approximately 15 per cent of the gross revenue collected from all classes of consumers. The keeping of accounts, reading of meters, billing and collecting are generally done in connection with the service of water. Insurance, depreciation, maintenance and proper utility accounting practices are in many cases given but little consideration. Finally, the city does not need to consider the cost and operation of far-flung lines into rural territory with their high investment and relatively low return. It considers only those consumers included within its boundaries—a class which has always been the most lucrative.

The privately operated electrical systems in California properly were built to serve all classes of consumers. The fact introduces diversity in load and demand through which all classes of consumers help all other classes in reducing rates. The fact that the peak demands of the various classes are not simultaneous makes it possible to serve more consumers with less investment in facilities. In other words, it improves the load factor of the entire system.

This diversity in load and demand is particularly evident with respect to the city and rural consumers. Their loads are mutually dependent and beneficial. The city load reaches its peak during the winter months, when the country use is low. The irrigation power load comes on heavily during the period of flush river run-off and attains its peak during the summer months, the period of low use in the cities and at a time when stored water must be drawn upon in order to satisfy irrigation water rights in the great interior valleys. The farm load thus fills in "the valley" of the city load and during that period carries more than its share of the system's cost, thereby making possible lower rates in the cities than would otherwise obtain. Separate either load from the system and a greater burden of capital costs, operation and maintenance falls upon the other.

There is no question that the city load is the "cream" of the utility business. It is equally true that the consumers in the cities are partially helping pay the cost of service to the rural sections, even though the rates in the cities are uniformly lower than the rates in the country. The loss of the city load to the present utilities will remove this means of support to the rural areas. These rural areas will then be thrown "on their own." Their rates will have to be raised, if they are to pay their full way, instead of something in excess of increment costs as they now do.

The incentive for further rural electrification and extension of lines and service will cease to exist. The utilities will become wholesalers, generating power for resale and wholesale purposes only, delivering it at high voltage to be sold in large blocks. The farmer thus will find himself deserted by both the municipal and private utilities.

I am fearful lest this present movement on the part of our cities to hasten the disintegration of our utility systems and its attendant, harmful effects on agriculture will so discourage and embitter the great thinking body of our rural people that they will revive that age-old conflict between the farm and the city. I know that the good people of our cities do not fully realize the ultimate effects which their contemplated dismemberment of the utilities will have upon their brothers in the rural sections. I feel, furthermore, that there is no desire on the part of the better-informed city inhabitant to be the moving cause in the renewal of an anti-social conflict.

An ample and dependable supply of electric power has meant much to the farmer—just how much is revealed in figures compiled by the California Commit-

tee on the Relation of Electricity to Agriculture. In 1931 thirteen California utilities supplied power under non-domestic schedules to 58,640 farmers who used 1,393,520,695 kilowatt hours of electric energy. The average rate paid was 1.32 cents per kilowatt hour. A higher percentage of farms in California—63.8 per cent—than in any other State in the Union receive electric service.

A continued supply of electric power for pumping of irrigation water is absolutely necessary to the economic operation of farm lands in California. Without irrigation water obtained at reasonably low costs, much of California's most valuable land would, beyond question, revert to the desert whence it was rescued. Therefore, electric service at the lowest feasible rates is vitally essential not only to California agriculture but to the entire State as well. The taking away by the cities of their load will deprive the present serving companies of a major portion of their revenue and must result in one of three alternatives:

(1.) The rates to the farmer will necessarily be greatly increased. This alternative is impossible of accomplishment, for the simple reason that the farmer has already reached the economic limit of ability to carry any additional capital or operating costs.

(2.) The power companies will be compelled to perform the service at a rate which will afford so low a return that investments in their securities will cease to be attractive to necessary capital. This, in turn, will inevitably increase the cost of money to the utilities and the completion of this vicious circle of lower return and higher costs will mean the virtual dissolution of these agencies, the development and service of which have materially contributed to the progress and prosperity of California.

(3.) The farmer will be compelled to revert to the isolated, individual power plant with its attendant high costs, inconveniences and lack of efficiency. This would compel him to junk the electrical equipment now in use, the cost of which amounts to millions of dollars.

Aside from the loss which agriculture would suffer were it to be deprived of a cheap and adequate supply of electric power for pumping, there is a social aspect to rural electrification which cannot be overlooked. Before the advent of electricity and the automobile, there was ample reason for the jealousy with which the rural housewife looked at her urban sister. Electricity has brought to the farm homestead every convenience enjoyed by the city household. Banished forever are the odious tasks of the farmer's wife. At a touch of a switch, she commands all of the electrical genii that grace the urban home. Must our rural population forego this service simply to satisfy the civic selfishness of the city dweller? Not if the city dweller fully realizes his own true self-interest.

Nor can the farmer accept the additional tax burden which any increase in municipal ownership will entail. If the cities insist upon condemning and taking over distribution systems within their boundaries, they will remove from the tax rolls properties which today are contributing millions to the cost of government. This tax burden must be redistributed over other tax-paying groups, and the farmer neither can nor should shoulder any portion of it. Here in California municipally owned utilities today deprive the State of more than a million dollars annually in taxes. So far, all efforts of the farmers to have these rightful taxes assessed through legislation have failed.

I appreciate the fact that the moving incentive to municipal ownership usually is the desire for lower rates. With this desire I am in full accord, but, in my judgment, this financial gain is only temporary and must eventually entail general community losses out of all proportion to the savings attained by the municipal consumers.

E.E.I. ENGINEERING COMMITTEE MEETINGS TO BE HELD IN CLEVELAND IN MARCH

Last Meeting Before the Convention

Meetings of the engineering committees of the Edison Electric Institute are scheduled to be held at Cleveland during the last week of March. All meetings will be held in the Hotel Cleveland.

POWER GENERATION COMMITTEE

The dates of the Power Generation Committee sessions are March 27th and 28th. This will be the last meeting of the Committee before the convention, and final reports will be received on all subjects assigned, which cover steam generating equipment, power station buildings, relations and arrangements between utilities and industries, Binary cycles and oil and gas engines.

Time has been set aside for the usual round-table discussion of pertinent subjects. This should be particularly interesting and advantageous as there are few opportunities for such discussions now. A full attendance of the committee is anticipated.

TRANSMISSION AND DISTRIBUTION COMMITTEE

The Transmission and Distribution Committee will hold their last meeting before the annual convention on March 26th and 27th. In addition to the regular work of the committee, arrangements have been made for a round-table discussion to be held on March 26th.

This round-table discussion will be divided into two sessions—one in the morning and one in the afternoon. Each session will open with a prepared paper by an authority on the particular subject under discussion, followed by several prepared discussions. The round-table discussion will deal with problems concerning the operating, design and construction phases of overhead distribution, and in both sessions the costs of distribution will be emphasized. All engineers interested in these problems are invited to attend these sessions and participate in the discussions.

The second day will be devoted to the regular work of the committee.

ELECTRICAL EQUIPMENT COMMITTEE

The Electrical Equipment Committee will be on March 28th and 29th. This, also, will be the last meeting of the committee before the convention, and the sponsors for all of the active subjects are expected to report so that the final reports on the Working Committee for the year may be prepared in time for the meeting at the annual convention in June.

Many of the subjects under study by the committee are of wide interest at the present time, and it is expected that there will be a full attendance. Ample opportunity has been allowed on the program for a full discussion of the pertinent subjects.

ELECTRIC WHIPPING MACHINE

An electric whipping machine for gangsters and racketeers has been suggested by Judge Joseph E. Corrigan of New York as a means of punishing the criminal at less expense to the state and leaving him free to work for his dependents.

APPARENT INACCURACIES IN 1932 CENSUS FIGURES ON MUNICIPAL PLANTS

TABLE 1—COMPARISON OF U. S. CENSUS FIGURES AND ACTUAL CITY REPORTS—PACIFIC COAST GEOGRAPHIC DIVISION—1932

Kilowatt Hours Sold

	As Shown by City Reports (Municipal Plants)					Total Municipal Plants in Pacific States as Reported by Census	Difference Between Census and Municipal Plants in 4 Cities
	Los Angeles	Pasadena	Tacoma	Seattle	Total 4 Cities		
Domestic Service	107,589,616	16,559,903	41,937,000	89,867,608	255,954,127	340,909,421	+ 84,955,294
Commercial Service:							
Small Light and Power.	174,610,680	11,510,421	27,212,441	60,556,206	273,889,748	704,873,179	+430,983,431
Large Light and Power.	262,637,703	15,761,218	95,106,023	92,914,387 (a)	466,419,331	91,206,872	—375,212,459
Total Commercial .	437,248,383	27,271,639	122,318,464	153,470,593	740,309,079	796,080,051	+ 55,770,972
Street Lt. and Municipal..	86,728,891	11,349,670	10,126,903	19,451,333	127,656,797	141,403,895	+ 13,747,098
All Consumers	631,566,890	55,181,212	174,382,367	262,789,534	1,123,920,003	1,278,486,552 (b)	+154,566,549 (b)
Number of Consumers....	232,133	31,265	37,500	95,448	396,346	529,418	+ 133,072
Revenues Received							
Domestic Service	$4,171,932	$663,870	$725,500	$2,532,018	$8,093,320	$11,151,767	+ $3,058,447
Commercial Service:							
Small Light and Power.	4,864,945	403,135	519,231	1,111,227	6,898,538	12,769,367	+ 5,870,829
Large Light and Power.	3,546,171	279,353	580,645	1,049,339 (a)	5,455,508	1,306,447	— 4,149,061
Total Commercial .	$8,411,116	$682,488	$1,099,876	$2,160,566	$12,354,046	$14,075,814	+ $1,721,768
Street Lt. and Municipal..	2,572,444	175,061	111,923	498,245	3,357,673	3,176,461	— 181,212
All Consumers	$15,155,492	$1,521,419	$1,937,299	$5,190,829	$23,805,039	$28,408,187 (b)	+ $4,603,148 (b)

Notes:

(a) Includes 32,847,010 kwhr. and $399,371 for power sold to municipal street railway

(b) Includes "farm service" of 93,185 kwhr. at $4.145

The recently released figures of the U. S. Census of Central Electric Light and Power Stations, covering 1932 operations of municipal plants, are, in some respects, of such doubtful accuracy as to seriously impair the value of the national totals and all the ratios which may be derived from them. Table 1, giving an analysis of the statistics for the Pacific Coast (California, Oregon and Washington), indicates a hopeless confusion between the classifications of "commercial-small light and power," "commercial-large light and power," and miscellaneous municipal services, with the result that the average revenue received per kwhr sold for retail commercial purposes is shown by the Census much below the figure which would result if sales were tabulated on a comparable basis with the private companies. As detailed in Table 1, the Census reported only 91 million kwhr for "Large Light and Power" for all the municipal plants of the Pacific Coast, whereas the published report of the Los Angeles system alone showed sales of 262 millions and Tacoma and Seattle showed 95 and 93 millions respectively. A transference, on a large scale, of sales from the large (wholesale) power classification into the small (retail) classification is indicated by this table, to the

TABLE 2—PACIFIC COAST STATES—1932

Average Revenues Received per Kwhr Sold

Classification	(a) Actual Results for 4 Cities* (Municipal Plants) Comprising 88% of Kwhrs Sold	(b) Probable Total (Municipal Plants): with Remaining 12% of Kwhrs Prorated	(c) As Shown by Census: All Municipals	(c) As Shown by Census: All Private Companies
Domestic Service	3.16c	3.27c	3.27c	3.93c
Commercial Service:				
Small Light and Power...	2.52	2.65	1.81	2.34
Large Light and Power...	1.17	1.25	1.43	1.13
Total	1.67	1.77	1.77	1.70
Street Lighting and Mun'l..	2.63	2.63	2.63	(†)
All Consumers	2.12c	2.22c	2.22c	2.04c

Note:

*Los Angeles, Pasadena, Tacoma, Seattle.

†No figure available; for street lighting alone, the average is 3.39c.

TABLE 3—PERCENTAGE OF ALL KWHRS SOLD BY MUNICIPAL PLANTS FOR EACH CLASS OF SERVICE IN THE UNITED STATES

Classification	4 Cities (a) Are % of Total U. S. A.	Total Pacific Coast Is % of Total U. S. A.
Domestic Service	18.5%	24.7%
Commercial, Small Light and Power.....	32.0 (b)	34.5 (b)
Commercial, Large Light and Power.....	54.3 (b)	58.4 (b)
Street Light and Municipal.....	20.0	22.2
All Consumers	30.0%	34.1%

Notes:

(a) Los Angeles, Pasadena, Tacoma, Seattle

(b) Revised totals, both for Pacific Coast and entire U.S.A.

complete distortion of all averages—both for the Pacific Coast and for the country as a whole. The situation is summarized in Table 2.

As is shown by Table 3 the Pacific Coast dominates the National statistics for municipal plants.

The revisions in commercial service, as indicated in column (b) of Table 2, would evidently change the national averages very materially. To obtain a clearer picture of the remainder of the United States, however, the following Table 4 has been set up by excluding the Pacific Coast from both the commercial and municipal categories. In addition, column (c) shows the average revenues per kwhr sold, computed on a tax-free basis by subtracting from each classification the proportion of taxes paid by commercial plants (10.88%) and by municipal plants (1.05%) in 1932.

TABLE 4—AVERAGE REVENUES RECEIVED PER KILOWATT HOUR SOLD—1932

Classification	(a) Total U.S.A. as Reported		(b) U.S.A. Excluding Pacific Coast		(c) On Tax-Free Basis		(d) Ditto: Tax-Free on Basis of 15% for Com'l Plants	
	Mun'l	Pvt. Cos.	Mun'l	Pvt. Cos.	Mun'l	Pvt. Cos.	Mun'l	Pvt. Cos.
Domestic Service	4.69	5.62	5.16	5.86	5.10	5.22	5.10	4.98
Com'l, Small Lt. and Pwr..	2.56	4.26	3.50	4.67	3.47	4.16	3.47	3.97
Com'l, Large Lt. and Pwr..	1.70	1.49	1.78	1.52	1.76	1.35	1.76	1.29
All Consumers	3.14	2.74	3.62	2.83	3.58	2.52	3.58	2.41

Since 1932, taxes on private companies have increased very materially without any compensation in increased rates, so that a more equitable comparison, based on present day conditions, will be found in column (d). This shows that the private plants are receiving a lower average revenue for domestic service when all disparities in taxation are taken into account.

Even these averages cannot, however, be regarded as entirely correct because errors similar to those shown for the Pacific Coast have probably been made in all other parts of the country but, until the Census releases its sales of large light and power by states for both municipal and commercial plants, it will be impossible to further verify the accuracy of its figures.

Electric Refrigeration

(*Continued from page 74*)

"Home Modernization—The Electrical Way." Many suggestions were contained in his talk on ways and means of furthering cooperative activities among the electrical dealers, regardless of whether they sold ranges, water heaters, washing machines or refrigerators.

Following the Seattle meeting his tentative schedule is as follows:

March 12, Portland
13, Sacramento
14, 15, San Francisco
16-22, Los Angeles and surrounding territory
23, San Diego
26, El Paso
27, San Antonio
28, Fort Worth
29, Dallas
30, Houston (noon)
30, Galveston (evening)
April 2, Port Arthur (noon)
2, Beaumont (evening)
3, New Orleans
4, Birmingham
5, Louisville
6, Cincinnati
9-13, Minnesota
16, Youngstown
17, Akron
18, Cleveland
19, Rochester
20, Syracuse

While on this trip it is planned that the Field Manager will visit at least 40 cities and will speak to at least 45 groups of dealers, distributors and central station men interested in the sale of electric refrigerators.

Many requests have been received by the Bureau for suggestions for spring electric refrigeration shows and other cooperative activities which would stimulate the sale of electric refrigerators. Most of these requests have come from local Electric Refrigeration Bureaus and indicate a widespread interest in getting the dealers together in some kind of coordinated program at the peak of the season.

Northwest Electric Association

At the time of the dissolution of the N.E.L.A. last year, there was little consideration given to the possibility of dissolving the Northwest Electric Light & Power Association. This group, operating in Oregon, Washington, Idaho, Montana, and Utah, had been in existence since 1908 and for many years functioned as a separate territorial association before it affiliated with the N.E.L.A. as a geographic division. Members generally conceded the desirability of maintaining an industry group in the Northwest, and with little readjustment were able to set up the Northwest Association on a wholly independent basis, thus capitalizing its going concern value.

The Association now provides four classes of membership: Utility Companies; Non-utility Companies; Individuals, and Honorary. Studies of industry problems are pursued through committees in three sections: The Accounting and Business Practice Section corresponding to the old Accounting Section; the Business Development Section corresponding to the former Commercial and later Sales Section; and the Engineering and Operation Section corresponding to the old Technical or Engineering Section. The change in the section names was made to make these names more broadly descriptive of their respective functions.

Officers are: President, L. T. Merwin, Northwestern Electric Company, Portland; Vice-president, R. J. Moore, Yamhill Electric Company, Newberg, Ore.; Treasurer, George Mackenzie, Northwestern Electric Company, Portland; Executive Secretary, Berkeley Snow, 707 Spalding Building, Portland.

State vice-presidents are: For Idaho, R. B. King, Idaho Power Company, Boise; for Montana, J. C. Ryan, Montana Power Company, Butte; for Oregon, C. M. Brewer, The California Oregon Power Company, Medford; for Utah, George M. Gadsby, Utah Power & Light Company, Salt Lake City; for Washington, L. R. Coffin, Puget Sound Power & Light Company, Seattle.

Directing the work of the sections are the following chairmen: Accounting and Business Practice, O. W. Bennett, Puget Sound Power & Light Company, Seattle; Business Development, R. B. McElroy, The Washington Water Power Company, Spokane; Engineering & Operation, William S. Hill, Grays Harbor Railway & Light Company, Aberdeen.

The Association year ends June 30, prior to which the work of the committees is brought to culmination in meetings of the various sections held separately.

RATES LOWERED ON MACHINERY INSURANCE FOR PUBLIC UTILITIES

By G. H. BOURNE
Chairman, Insurance Committee E. E. I.

The following article, contributed by the Insurance Committee of the Edison Electric Institute, announces reductions of rates for machinery insurance, effective April 1, 1934, and also describes in some detail the types and extent of the various coverages available.

The Edison Electric Institute Insurance Committee was recently informed by the National Bureau of Casualty and Surety Underwriters that effective April 1, 1934, rates for machinery insurance on large size turbines, electric generators, rotary converters, transformers and induction feeder regulators, together with all rates for machinery use and occupancy insurance will be materially reduced.

The principal class of objects affected by the rate reductions are steam turbines. For breakdown and limited breakdown coverage the reductions in rates for the larger units are as much as 30 per cent, and average about 20 per cent. For explosion coverage, rates for the larger units will be reduced about 10 per cent on the average. For so-called "combined coverage" there will be a reduction of about 15 per cent for the larger units. For water turbines the reductions in rates are less than for steam turbines, but in some cases run as high as 12 per cent.

Rates will also be materially reduced for several classes of electric machines, namely, generators, rotary converters, transformers, and induction feeder regulators. For generators the reduction in rates for large units are as much as 35 per cent, and average about 20 per cent. For rotary converters the reductions amount to about 15 per cent for all sizes up to 1000 kw with greater reductions for larger sizes. For transformers and regulators the reductions average about 25 per cent for larger sizes.

Member companies carrying these classes of insurance would do well to check with their brokers or agents and ascertain the desirability of cancelling and rewriting their policies so as to obtain the benefits of the reductions.

The policy used for machinery insurance of all classes is a standard form. This standard form contains a definite agreement on the part of the insurance company to pay within the amounts of insurance purchased, the following kinds of losses, certain of which are elective:

(1) Loss on property of the assured directly damaged.

(2) Loss due to the extra cost represented by items of expense for temporary repair or for expediting the repair of damaged property of the assured, including overtime and the extra cost of express or other rapid means of transporting material. This is an elective cover which may or may not be taken by the assured.

(3) Loss which the assured shall become obligated to pay (including investigation and defense of claims or suits alleging such damage) for damage to property of others, including liability for loss of use of such damaged property of others.

(4) Loss for liability (including liability for loss of services) on account of bodily injuries and death sustained by persons not employees of the assured. This is an elective cover which may or may not be taken by the assured.

(5) Loss due to costs taxed against the assured in any legal proceeding defended by the insurance company, including interest and expenses.

This standard form is then modified by the attachment of schedules dependent upon whether breakdown, limited breakdown, explosion, etc., insurance is wanted.

Breakdown coverage is the broadest form written, providing protection for the complete unit of turbine and driven machine against loss from a sudden and accidental breaking, deforming, burning out or rupturing of the unit or any part thereof, which manifests itself at the time of its occurrence by immediately preventing continued operation or by immediately impairing the functions of the unit and which necessitates repair or replacement before its operation can be resumed or its function restored.

Limited breakdown coverage, as applied to steam turbo-generators, is the same as breakdown except that the short-circuiting, burning, breaking or loosening of electrical conductors or their insulation or of the band wires or wedges is excluded.

Explosion coverage is a very limited form. It covers the turbine unit (including the driven machine) against the sudden and accidental tearing asunder of the unit, or any part thereof, caused by pressure of steam therein, or a sudden and accidental disrupting of its rotating members into two or more parts, but excludes the breaking, cracking, stripping or loosening of gears or couplings or of movable or stationary blades or buckets or of shroud rings or other blade or bucket fastenings, and also excludes the short-circuiting, burning, breaking or loosening of the electrical conductors or their insulation or of the band wires or wedges.

Combined coverage affords protection for turbo-generators against the same hazards covered under Explosion coverage and, in addition, affords full breakdown coverage on the generator end of the unit.

The various forms of machinery policies written can be modified to provide for a deductible liability under which the assured agrees to retain the first part of a loss, the insurance company standing the remainder. For instance, a policy can be written under which the insurance company pays for all loss or damage in excess of the first $10,000. Under such an arrangement substantial reductions in the premium are allowed.

Provision may also be made for suspension of insurance due to non-operation. Where such suspension is in excess of three consecutive months a return premium is allowed. Under circumstances where a machine must be turned over for maintenance purposes or for other reasons during a period of non-operation, the ordinary suspension endorsement may be modified to permit operation of the unit for maintenance periods of not over 12 hours with 5-day intervals (called "Weekly Basis") or for maintenance periods of not over 48 hours with 25-day intervals (called "Monthly Basis"), the coverage applying fully during the maintenance periods. For this modification a small additional premium is charged.

There are two other forms of endorsement which may be attached to

(*Continued on page 96*)

WE STARTED IT IN THE GAY NINETIES

Where Are We Now?

The earliest commercial and public relations letter that has come to the writer's attention is one written by the late C. L. Edgar in 1890, then General Manager of the Edison Electric Illuminating Company of Boston. A reproduction of the letter accompanies this article. Attention is solicited to "an examination of the work being done, and of the substantial character of the materials used by which you will be insured permanent and satisfactory service."

The service, and the method of supply was a dominating feature to gain public attention.

At that time the utility company depended for its revenue on lighting only. There were not a few score of appliances available for the home; scarcely any electrically operated equipment for commerce, and there were not hundreds of motor driven applications and heating devices for industry.

Perhaps we can blame the delay in the growth of this great electric light and power industry to the delayed perfection of mechanisms of many kinds through which electric service was to be rendered. But we will more nearly "hit the nail on the head" when we say that the lack of proper kind of advertising, and in amounts commensurate with the national advertising programs of other industries has been the real cause for our failure to produce greater energy sales in the home. We have been lulled by the croonings of those who have said we were a "natural monopoly" and had no competition.

Three years after the Boston Edison letter discussed here was written, the Southern California Fruit Exchange was organized (1893) and two years later limited trade paper advertising begun. Periodically since that time for forty years the Southern California Fruit Exchange has conducted organized promotion and advertising. That is why orange juice is at every breakfast table and the per capita consumption of citrus fruits has had such an amazing growth.

Five years ago at the National Convention of the former National Electric Light Association the writer had the temerity to recommend an expenditure for national advertising for the electric light and power industry of $1,000,000 per year. To quote from that address, "We must outdistance competition, and an advertising fund, starting with a modest million yearly for selling domestic service and increasing as we gain selling momentum, would be a stable foundation for other national and local tie-ins. I say 'modest million' because the estimated gross revenue from domestic service last year was approximately $502,000,000 and $1,000,000 would be less than 2/10ths of 1 per cent of the total gross—a small percentage indeed."

Again quoting from that same message, "The duty of every power company is to sell the use of electricity to the people of Main Street and Wall Street. People must know WHY they should use it—the appealing WHYS such as the health, comfort and convenience wrapped up with every kilowatt-hour, as well as they know why 'Saving the Surface Saves All' with varnish."

These statements bear repetition. People will give only a limited amount of their income for Electric Service in connection with household use UNLESS—they are sold on the WHYS they should use it.

How much of the percentage of gross revenue will the utilities allot for this basic industry need?

C. E. GREENWOOD.

EDISON ELECTRIC ILLUMINATING CO. OF BOSTON.

GENERAL OFFICES

3 HEAD PLACE.

Officers.
JACOB C. ROGERS, President.
W. POWELL MASON, Vice Prest.
HUBBARD BREED, Treasurer.
C. L. EDGAR, Genl. Manager.

Directors.
EDWD. H. JOHNSON. JACOB C. ROGERS.
F. S. HASTINGS. T. JEFFERSON COOLIDGE.
C. M. COSTER. W. POWELL MASON.
GEO. S. SILSBEE. RICHD. D. ROGERS.
HUBBARD BREED.

Boston, April 1, 1890.

The undersigned begs to call your attention to its system of electric light and power which it is furnishing to the citizens and business men of Boston.

Up to the present time the current has been supplied in your section of the city through overhead wires; but during the coming two months all this is to be replaced by the regular underground system, which has been in successful use in Tremont, Washington, and neighboring streets during the past four years.

Your attention is called to the matter at this time because the Company is now engaged on your street, and it solicits an examination of the work as being done, and of the substantial character of the materials used, by which you will be insured permanent and satisfactory service.

The enclosed circulars will give you general information; and, in addition, an agent will call and give you full and definite data of cost of wiring, lighting, &c.

Kindly notify the Company on the enclosed postal of your wishes in the matter

Yours respectfully,

EDISON ELEC. ILL. CO. OF BOSTON,
By C. L. Edgar,
General Manager.

COAL, WATER, AND ELECTRICITY

By T. G. Le CLAIR

Development Engineer, Commonwealth Edison Company

A paper submitted in the 1933 McGraw Prize Award Competition

Three essential elements of the bulk electricity supply system to a metropolitan area are: fuel, cooling water, and the demand for electricity. The variations in location and availability of these elements are largely responsible for the different fundamental plans of supply to the large cities in the United States.

Rarely indeed are these elements found at one location. Coal is seldom to be found near the load center. It is common practice and usually most economical to ship coal to stations near the load and transmit electricity from there. Several careful comparisons have shown that if the distance is great, coal can be shipped more cheaply and safely than the same energy in the form of electricity. For this reason mine-mouth generation has lost its popularity as a topic for newspaper stories.

Four hundred pounds of cooling water are required per pound of coal for steam generation, so it has quite naturally been taken for granted that the generating station must be located at the water's edge. A sound economic analysis may show that under some conditions, pumping water to a station at the load center is cheaper than transmitting power from a station at an adequate water supply.

This paper presents an abbreviated illustration of a comparison of the merits of sites for generating capacity to supply a metropolitan load. It shows that to pump water eight miles through solid rock is economical. The analysis is presented now, when there is an excess of generating capacity, because of the long time required after policies are established to acquire land, dig tunnels and build stations.

Chicago North Side Problem

As an example of how locations for generating capacity may be analyzed we may consider the supply of additional energy for one section of Chicago which contains over one-fourth the total load and is now fed radially from the switchhouse of one generating station. This area has at its center the present Northwest generating station, from which the dependent load is supplied through underground cables at the generating voltages of 12,000, 60 cycle and 9000, 25 cycle. The load in this area now totals over 250,000 kw. The capacity of the present turbine generators is 165,000 kw and cannot be increased with the present water supply, which is limited by the flow in the north branch of the Chicago River.

We therefore have as a starting-point of our problem the ultimate need for additional power to supply this ready-made load, which may be expected to increase in the reasonably near future to 400,000 kw or more. To simplify the study, we may consider that the present generating capacity, together with the existing interconnections to other stations contain ample reserve capacity for provision against loss of generators. The problem then is to provide, somewhere in the Chicago district, additional generating capacity when needed for load increase and deliver its output to the established center of distribution at Northwest.

There are several possible sites where the new generating capacity may be installed. No locations on the lake front in Chicago can be included as the en-

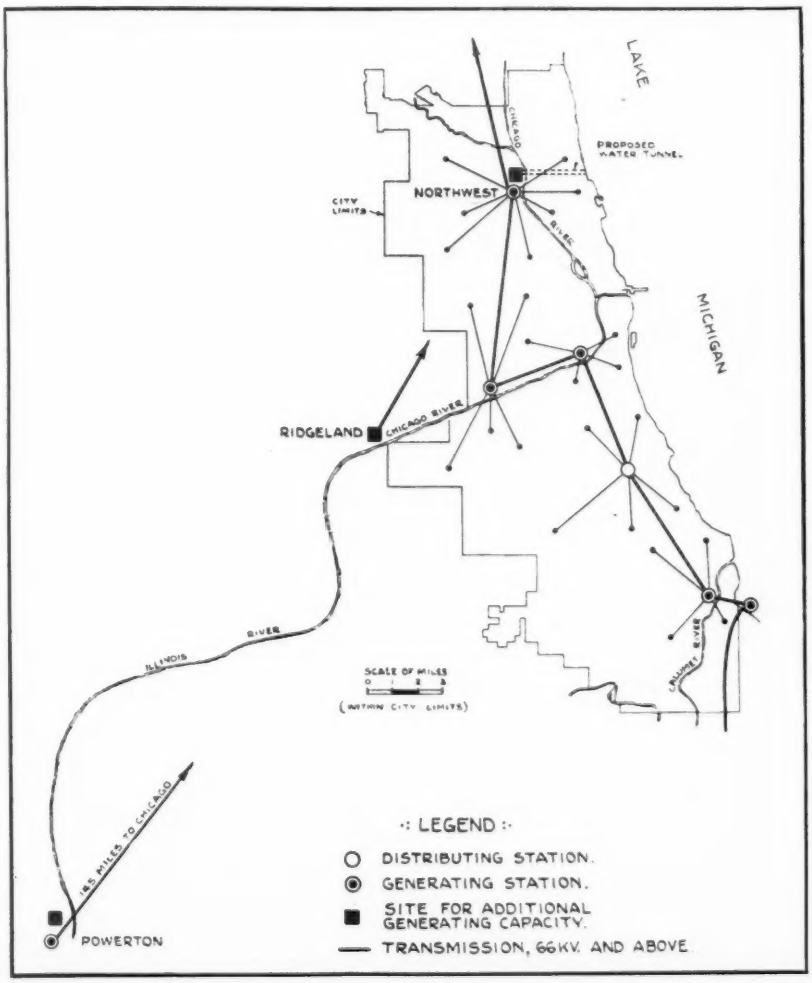

Fig. 1—Locations of present generating stations in Chicago and three possible sites for new capacity to supply the Northwest load.

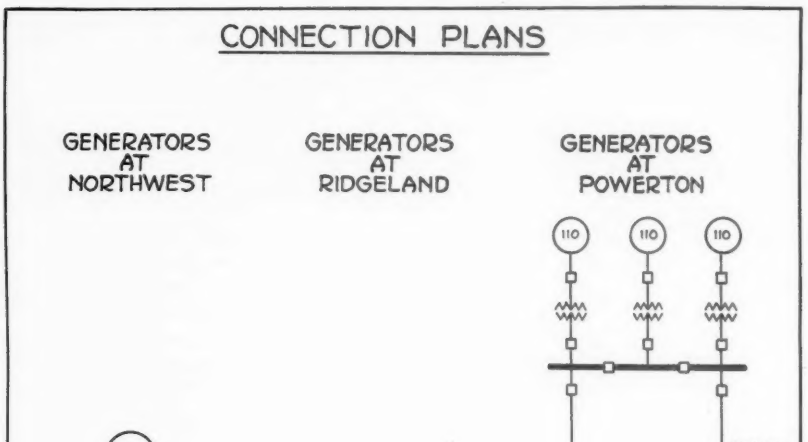

Fig. II—Connection plans to add 300,000 kw. net generating capacity to the Northwest 12,000-volt bus with three different locations of the generators.

tire shore line is reserved by zoning laws for dwellings and parks. To compare the merits of the several sites we may assume that the ultimate additional capacity required is approximately 300,000 kw delivered to the Northwest Station bus.

Three available sites for the generators are shown on the map of the city, Figure 1. The salient features of the three are:

No. 1—Northwest: Ample land exists at the site of the present station to build 300,000 kw in additional turbine plant. The present supply of water, as previously stated, is only sufficient for the present generating equipment, which was installed 15 to 20 years ago. The nearest available supply is Lake Michigan, which is slightly less than four miles from the station on a direct line. It is not practicable to take water from Lake Michigan for cooling purposes without returning this water to the lake, because of the International Treaty limitations on the amount of water which may be diverted from the lake into the Chicago River. The supply of coal comes from fields in Central and Southern Illinois, where the relation of freight rates and quality of coal is such that the cost per kwhr of the fuel from the two fields delivered to Chicago stations is approximately equal.

No. 2—Ridgeland: Land is available for a new generating station on the Chicago River approximately five miles below the present Crawford Avenue generating station, where there will be an additional water supply of approximately 1000 cu. ft. per second from the discharge of a sewage disposal plant now under construction. The freight rate on coal is the same as to Northwest because both stations are located in the uniform freight rate area served by the Belt Railway of Chicago. From this site to the load center at Northwest, underground transmission must be used over a street distance of approximately 14 miles.

No. 3—Powerton: The site of the present Powerton Station on the Illinois River southwest of Chicago provides ample land and ample cooling water for the additional capacity. The station is so close to the Central Illinois coal field that fuel cost is nearly 20 per cent less than at Chicago stations. The shortest right-of-way for overhead transmission to Chicago is about 145 miles. Underground transmission must be used from the city limits to Northwest.

Description of Plans

To simplify the cost comparison and to make the unit size a reasonable fraction of the total interconnected system, the net capacity of each generating unit is arbitrarily chosen as 100,000 kw plus the capacity needed to supply transmission losses from the generating site to the load center at Northwest or to supply pumping losses.

The method of transmitting from the generators to the point of delivery at the Northwest low voltage switches under the three schemes is shown diagrammatically in Figure II. Interconnections with the present 12,000 volt generators at Northwest and the higher voltage interconnections with other stations are also not shown on the diagram to further simplify the comparison.

If the generators are installed at Northwest, each unit will be connected to the 12,000 volt bus and will have a capacity of 104,000 kw to supply 100,000 kw to the load plus 4,000 kw of additional capacity for pumping cooling water from Lake Michigan to the generating station and back.

The pumping of cooling water from Lake Michigan to the station and return presents a very interesting problem. A double underground tunnel must be built approximately four miles long with an intake crib in the lake and with an outlet at some point on the lake-front. Various tunnel sizes may be used to provide the maximum water supply of 1,000 cubic feet per second, which has been assumed for the 300,000 kw net output capacity. As the size of the tunnel increases, the friction losses decrease very rapidly, but the construction cost of the tunnel increases. The curve in Figure III indicates approximately the rate at which the fixed charges on tunnel investment and the annual costs of pumping vary with the tunnel diameter. The curve shows that near to the most economical tunnel size, the area of cross section may be varied within reasonable limits without appreciably changing the ultimate total cost of the water supply. From a curve similar to the example we find that the most economical size of tunnel would have an inside diameter of 16 feet, with a center wall, using one-half the tunnel for an intake and the other half for an outlet.

It is quite possible that for actual construction twin tunnels would be substituted for the single tunnel with a wall. Each of the twins would have an equivalent inside diameter of 11 feet. The

construction costs would probably be about equal and the power loss in friction would also be about equal in either case. The twin tunnels would reduce the heat transfer from outlet to inlet water.

If the Northwest site is developed it might also be possible to combine the pumping of water for cooling purposes and supply for other uses in the city. The use of this water for cooling does not contaminate it in any manner. It could be used for drinking at all times except possibly in summer when the increase in temperature by passing through the condenser would make the water unpalatable. If the water were not used for drinking, it might be liberated in one of the lagoons along the lake-front to permit swimming for a longer season of the year.

With the generators installed at Ridgeland, the simplest and cheapest plan of supplying to the Northwest area is to connect each generator direct to a 14 mile, 66 kv transmission line delivering all its power to the Northwest 12,000 volt bus. This eliminates the cost of high voltage switching equipment and reduces the cost of voltage regulating equipment, since the generating voltage can be varied to compensate for part of the line regulation. Each generator is 102,500 kw net capacity, to supply the load plus the 2.5 per cent line loss. The 66 kv lines each have a rating of 120,000 kv-a at maximum ground temperature to permit the generators to operate at their rated power factor of 85 per cent.

In the case of Powerton the line loss is approximately 10 per cent and the generating units are therefore 110,000 kw each. For transmission from Powerton to Chicago, 220 kv is the most economical voltage available for overhead lines and this voltage can be used to the city limits. Only two 220 kv lines are used from Powerton to Chicago, a distance of 145 miles. Each of these 220 kv circuits is limited by its electrical characteristics to about 200,000 kw, so that the loss of either transmission line will interrupt 100,000 kw in generating capacity in the same manner as assumed for the other plans where each unit will deliver 100,000 kw. For transmission from the city limits to Northwest, 66 kv is chosen as the transmission voltage because the existing underground high voltage system within the city is at this voltage. For simplicity, one step-down transformer bank is connected to each of the 66 kv

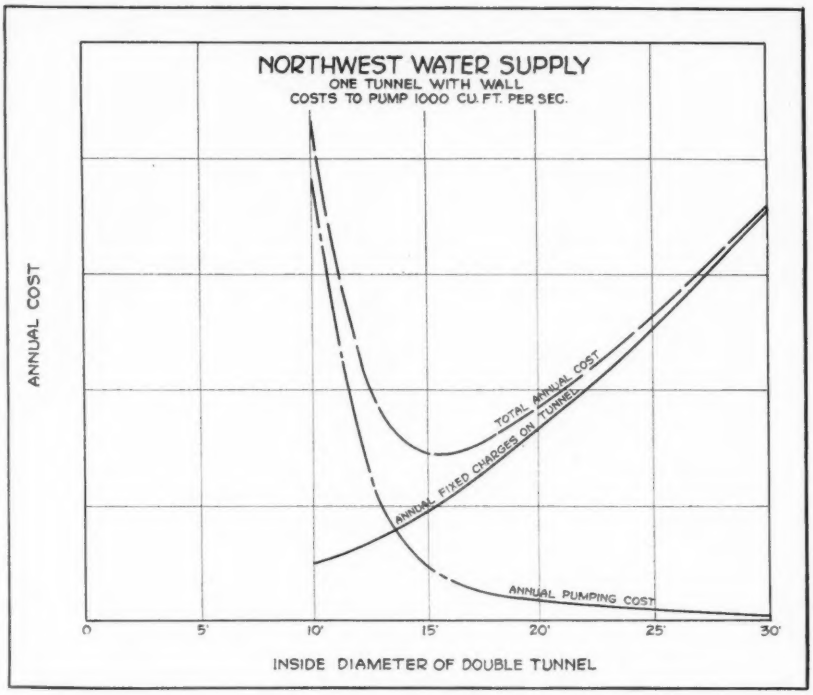

Fig. III—Curve illustrating how the cost of pumping water through a lined rock tunnel varies with tunnel diameter. A maximum discharge of 1000 cubic feet per second is assumed with an annual load factor of 60 per cent. The tunnel is divided, one-half being used for the intake and the other for discharge.

transmission lines. A third winding is used in each of these transformer banks for connection of a 50,000 kv-a synchronous condenser which must be used to compensate for the reactive drop in the long overhead transmission line. Another transformation is required at Northwest to deliver 12,000 volts to the Northwest bus.

Investment Comparison

The comparative investments required to supply equal amounts of capacity with generators at the three sites are shown in the tabulation, Figure IV. The estimates do not represent the complete cost of the stations at each location. They are for purposes of comparison only and do not include the land

INVESTMENT TABLE

	Location of Generators		
	Northwest	*Ridgeland*	*Powerton*
Generating capacity: 300,000 kw plus capacity for losses	312,000 kw	307,500 kw	330,000 kw
3—Generators at $100 per kw including building	$31,200,000	$30,750,000	$33,000,000
Extra Pumping equipment	300,000	.....	.....
1—16-foot double tunnel 4 miles with one crib	4,000,000	.....	.....
3—Step-down Transformers 120,000 kv-a each 66/12 kv with regulators	.....	1,200,000	1,200,000
3—66 kv underground lines with conduit each 14 miles, 120,000 kv-a	.....	5,700,000	5,700,000
3—Step-up Transformers with switches 120,000 kv-a, each, 12/69 kv, no regulators	.....	1,050,000	.....
3—Step-down transformers, 3 winding 120,000 kv-a each, with regulators and 66 kv switches	.....	.....	2,100,000
3—50,000 kv-a condensers and switches	.....	.....	1,050,000
2—220 kv terminals, 7 switches each	.....	.....	850,000
3—Step-up transformers 130,000 kv-a each, 22/230 kv, with regulators and switches (low tension)	.....	.....	1,500,000
2—220 kv lines 145 miles long	.....	.....	9,000,000
	$35,500,000	$38,700,000	$54,400,000
Excess over Northwest	.....	$3,200,000	$18,900,000

Figure IV. Comparison of investment to provide 300,000 kw generating capacity to the Northwest 12,000 volt bus exclusive of those items which will not be affected by location of the generators. See Figure II for connections of equipment listed.

ANNUAL COST TABLE

	Location of generators		
	Northwest	*Ridgeland*	*Powerton*
Kw-hr delivered in millions @ 60% load factor.....	1,600	1,600	1,600
Kw-hr losses in millions @ corresponding load factor.	50	30	160
Kw-hr generated in millions.....	1,650	1,630	1,760
Coal cost @ 2.1-2.1 and 1.75 mils./kw-hr.	$3,450,000	$3,400,000	$3,050,000
Other production costs	850,000	850,000	850,000
Fixed charges (12½% of Figure IV totals)	4,450,000	4,850,000	6,800,000
Total Annual Cost	$8,750,000	$9,100,000	$10,700,000
Excess over Northwest location.....	.....	$350,000	$1,950,000

Figure V. Comparison of annual costs to provide 300,000 kw capacity to the Northwest 12,000 volt bus. Accurate as to differences in totals only as each item represents only those parts of the total generating cost which might vary with different locations of the generators.

which is already available, or the cost of the 12,000 volt switch-house, or other items which would be common to all of the three schemes of supply and therefore would not affect the comparison.

The tabulation shows that the least total investment is required to install the generators at Northwest. If the generators are installed at Ridgeland the investment is greater by $3,200,000 and if installed at Powerton it is greater by $18,900,000.

For the initial installation of only one unit the balance is not the same. The tunnel cost is all incurred with the first unit at Northwest and makes the initial investment $1,500,000 greater than with the turbine at Ridgeland. The cost of developing the site for the new station at Ridgeland will partially offset this difference and the reduced pumping losses at low velocity will improve operating efficiency at Northwest. There is some possibility that arrangements could be made to dig only one of the twin tunnels with the first unit and temporarily dump some water in the river.

Annual Cost Comparison

The total annual cost of supplying energy from the proposed new generating capacity wherever installed will include the coal cost to generate the energy, plus the miscellaneous other production costs, plus the fixed charges on the investment for the equipment to be installed. For the determination of total annual costs shown in the tabulation, Figure V, the costs per kwhr are given for the new modern units installed in each location, with the cost of coal based on present rates to these locations. It will be seen from this table that the coal cost of generation at Powerton is materially less than the coal cost at either of the local stations in spite of the increased transmission losses. The fixed charges on the additional transmission equipment more than offset this difference. The minimum total annual cost is obtained by installing the generators at Northwest. With the generators at Ridgeland the annual cost is only $350,000 greater but with the generators at Powerton it is $1,950,000 greater.

In the illustration the cost balance in favor of the generators at the load center applies where additional transmission lines are required for all the additional load, but does not apply in case of the existing installations where the transmission lines between stations were installed primarily for intermediate load and their use for bulk power transmission is incidental.

Reliability

An underground tunnel through solid rock is practically proof against any kind of interference. Some of Chicago's water tunnels have been in use for sixty years or more and are apparently still in excellent condition. Maintenance is also negligible except at the exposed ends. The station at Northwest using a tunnel can be considered as safe as one at the water supply.

The generators at Ridgeland have an added risk of interruption due to cable or transformer failure. This class of equipment has little exposure to the elements and the failures from internal causes are now comparatively infrequent.

Transmission from Powerton presents the most difficult problem. The 145 miles of overhead lines is subject to lightning and other external forces which demand extra quality in construction. Provision must also be made in case of line failure to automatically reduce the generator output by either disconnecting a unit or transferring its output to lines over other routes. With these provisions we may expect reliable service but not equal to that from Ridgeland or Northwest.

Conclusions

In this case, locating the generators at the load center is not only more economical but more reliable, as a solid rock water tunnel is not subject to external damage as are the transmission lines, and is practically proof against interruption. In addition to the other advantages, there is still another possible economy in the load center location. This is that the water pumped from the lake may not have to be returned to the lake but could be discharged into the city water system. The only real objection to this scheme is the increase in temperature of the water after passing through the condensers. This argument would have little force during the winter months and in summer would not be important if the volume of water discharged from the condensers is only a small part of the total demand of the water supply system. The cost of a water tunnel may make the initial investment slightly higher at Northwest than at Ridgeland. If such is the case, economies with the second unit will more than offset the difference.

The example is much simplified and only serves to show that we may accurately determine the most economical location for generating capacity from the known availability of the essential elements: fuel, cooling water and the demand for electricity. Much time is required after the decision is reached, to secure land and water rights before the station is built. The basic economics will change very little during this period and the major investment need not be made until the demand occurs. Therefore, the economic study may and should be made, and the policy determined many years before the generators are needed.

PRIVATE OWNERSHIP

"Believing that the human factor and not the system is at fault, I hold without qualification, that the present system of private ownership—although sometimes it runs most imperfectly—is the best product to date of our experience, that this system can be brought to a higher degree of perfection in the future than can any other system, and that it would be anti-social to change it without a full examination of all the facts."—*John E. Zimmermann.*

PROBABILITY THEORY AND SPARE EQUIPMENT

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A paper submitted in the 1933 McGraw Prize Award Competition

In the engineering of power systems one of the most important objects is the attainment of a high degree of continuity of service to the customers. In attempting to achieve this many millions of dollars are spent for reserve equipment and protective devices. Seldom, however, is the proper degree of service reliability defined in quantitative terms, and rarely does the designer employ a truly rational method to attain it. The goal is undefined, and the means of reaching it unscientific and wasteful.

The problem arises because man has never been able to build a machine which can be relied upon to run day in and day out without, sooner or later, either requiring maintenance or breaking down from some cause not altogether foreseen. When such interruption occurs, the purpose for which the machine was intended cannot be served until repairs have been made. If the service performed is so valuable that it can be dispensed with only at considerable inconvenience or economic loss, the obvious expedient is to install a substitute or spare machine to operate if and when the first machine is unavailable.

If the "machine" be a boiler, a turbine, a generator, a transformer, or some other piece of equipment employed in the generation or distribution of electrical energy, its function is of such importance that almost invariably it has a spare ready to carry on when an emergency arises. In some cases where the equipment in question is complex and inherently subject to frequent interruption, it may be necessary to employ more than one spare unit—perhaps two or conceivably even three. Frequently, however, a single unit is considered sufficient to protect several other units.

In practice, the answer to the question of how much spare to install is usually provided by some rule of thumb or "policy", based to a degree on actual experience, but more often on some inherited tradition, the origin of which is obscure or totally forgotten. Time-honored rules of this sort, while seemingly satisfactory, are frequently grossly illogical, and lead in some instances to the provision of insufficient spare capacity, and in other cases to the installation of far more reserve than is necessary. For example, in the installation of substation supply cables, it is the practice of some power companies to install as many cables as the peak load demands plus one cable to serve as spare for the others. A study of the load duration curve together with an analysis of the probabilities of cable failure will usually reveal that where one cable is needed for load and one is installed as spare the reliability of service is distinctly inferior to that of the case in which, say, five cables are required for load and one spare is provided. Actually, one regular cable plus *two* spares may be more nearly comparable in reliability to five regular cables plus *one* spare.

It is the purpose of this paper, first, to call attention to the possibility of a rational solution of the problem of spare capacity by means of the theory of probability; secondly, to present an elementary technique for such solution, using as an illustration a hypothetical power system and applying the principles to the generating units; and finally to present the results of certain calculations which will serve as a rough guide to the number of spare generating units required in systems of various sizes.

It is important to differentiate between two general causes which may result in interruption to service. The first of these, catastrophic in nature and widespread in effect, results in the disabling of an entire generating station or even an entire system. The occasion may be fire, riot, explosion, earthquake, unprecedented low tide (in the case of tidewater steam stations), failure of fuel supply, strike, etc. Against such emergencies the mere multiplicity of generating units does not effectively insure. The second cause is the chance coincidence of a number of discrete happenings, such as the simultaneous failure of individual units. Against these occurrences spare or extra units can provide insurance in greater or less degree. From a knowledge of the behavior of individual units, the expected number and extent of these occurrences is definitely calculable, and by varying the number of spares the interruption to service can be made as great or as small as may be desired. It is with the second type of cause that this paper is particularly concerned.

It may at first appear that the problem of spare capacity is not at this time particularly important because of the fact that generally throughout the country power systems are operating at loads below the levels of former years, and as a consequence, having had a reasonable amount of spare then, they now have more than ample insurance against loss of load due to simultaneous equipment outage. This over-expanded condition, it may be hoped, is temporary. Even now in many instances it may be possible and desirable to scrap or at least close down old and inefficient plants, and in situations of this kind it is decidedly important to be able to form an accurate estimate of how much such a curtailment program would affect reliability of service, or to be able to determine rationally at just what point retirement of spare or standby equipment would begin unduly to jeopardize continuity of service.

Looking to the future, whenever further growth in load shall take place, an understanding of the application of probability theory to the problem of how much spare capacity should be provided can do much to prevent the overexpansion of plant facilities and at the same time assure reasonable standards of service reliability.

It will be well at the outset to give certain explanations and definitions of terms. The dictionary definition of *probability* is given as "the ratio of the chances favoring an event to the total number of chances for and against it." Mathematicians give more elaborate and precise meanings to the word, and even differ among themselves as to exactly what the term should connote. The so-called frequency definition will be useful for the present purposes: "If a large number of trials be made under the same essential conditions, the ratio of the number of trials in which a certain event happens to the total number of trials will approach a limit, and this limit is the probability that the event will happen." Thus the probability that a power system will, because of simultaneous generator outage, be forced to drop load is practically the ratio of the number of

hours such outage would occur to the total number of hours of operation if the system were operated for a very long period of time. It is evident from either definition that the measure of probability is some fraction lying between zero and unity, zero representing impossibility and unity denoting certainty.

Expectation is the product of the probability and the number of trials, or in the present instance it may be thought of as the product of probability and time. Thus, if the probability of load outage under certain conditions is 1/1000, the expectation of load outage in 50 hours is 0.05 hour.

The expectation of load outage in hours or minutes per year may be taken as the definition of *reliability of service.*

The problem of how much spare to provide resolves itself into two distinct parts:

First, how good shall the service be? What expectation of load outage in a year shall be deemed satisfactory? Perfect service can never theoretically be attained. Regardless of how much spare is provided there remains a certain probability of simultaneous failure of enough equipment to cause load outage, and this probability, no matter how infinitesimal, times the period under consideration gives a certain expected length of outage. It may be an hour in a year, or a second in a century, but it cannot be reduced to zero. Much might be written on what this expectation, or reliability, should be, and on methods, rational and otherwise, of arriving at its value. While it is not within the province of this paper to discuss this part of the question in detail, the desirability of determining such a value to be set up as a standard of service reliability should be emphasized.

Secondly, once this standard has been agreed upon, the system should be engineered to meet it. From the coal pile to the customer's meter exists a series of apparatus—a kind of chain, each link of which may at times fail. The sum of the outage expectations of each of these links must be made equal to the outage expectation set up for the system as a whole. Suppose (simply for illustration) it were agreed that an average outage per customer of twenty minutes per year was permissible. Two of these minutes might be assigned to the generating system. On this assumption, the procedure in an existing system would be to make a probability study of the generating units to determine whether or not the expectation of outage met this figure. If it exceeded two minutes, additional spare would be needed; if it fell below two minutes, certain equipment could be retired, or if this were not desired could be shut down until such time as load increase again required its use.

The solution of problems of outage probability is based on the method and formulas of A. K. Erlang of Denmark, who originally applied them to certain telephone exchange problems. As far as the writer knows the method has not hitherto been applied to questions of power system reliability. While apparently somewhat cumbersome, the method is in reality simple, and when once well understood is easy to apply. After a little experience, ways of greatly simplifying the calculations will readily occur to the user.

Erlang's solution introduces the concept of "statistical equilibrium" which may be stated as follows, using for illustrative purposes the example of a power system having a certain number of generating units interconnected and operating in parallel:

If repeated observations could be made on a very large number of such systems, each system consisting of the same number of units and each unit having the same characteristics determining its likelihood of failure, it would be found that the proportion of systems in which any number of units, x, were at any instant simultaneously unavailable, had a value which was independent of the particular time of observation. From this it follows that the number of systems which during a short interval of time changed from having x units out of service to having $x+1$ units out of service must have been counterbalanced by approximately the same number of systems having made just the reverse change in state, that is, from having $x+1$ units out of service to having x units out of service.

In simpler terms: assuming we could look at 10,000 systems, each of which had, say, 12 generators, we should always find that some systems were operating with all their units available, that some systems had one unit unavailable, that some had two unavailable, a few had three, a very few four, and so on; and we should further observe that the proportion of systems having, say, two units out was always approximately the same. From this we should conclude that as certain systems changed from having two units out of service to having three out, in a like number of other systems, which had three units out, a unit was repaired and returned to service reducing the units out in those systems from three to two.

Considering now a single system, if "a" is the average number of times a single generating unit fails during an extended service period T, the probability that during any short interval of time dt the unit will fail is $\frac{a}{T}.dt$. If n units are in service the probability that one will fail during the interval dt is practically n times as great, or $\frac{na}{T}.dt$.

If a damaged unit requires an average length of time, r, for repairs or replacement the "rate" at which the unit will be returned to service is $\frac{1}{r}$ and the probability of its being returned to service in the interval dt is $\frac{1}{r}.dt$. If x units are under repair the probability that one of them will be returned to service in the interval dt is practically x times as great, or $\frac{x}{r}.dt$. If, now, dt is made so small that only one change of state can occur, the equation may be written:

$$\frac{na}{T}.dt\ f(x-1) = \frac{x}{r}.dt\ f(x) \quad \ldots\ldots (1)$$

in which $f(x-1)$ represents the probability that exactly $x-1$ units are out of service, and $f(x)$ the probability that x units are out.

The left hand side of equation (1) represents a compound probability — the existence probability of a certain state or condition, i.e., $f(x-1)$, the probability that $x-1$ units are out of service, times the probability during dt of a change in that state, i.e., $\frac{na}{T}.dt$, the probability that a unit will fail, increasing the number of units out from $x-1$ to x. Similarly, the right hand side of the equation expresses the product of the probability, $f(x)$, that x are out of service, times the probability, $\frac{x}{r}.dt$, that one of these x units will be repaired and returned to service during dt, thus reducing the number of units out from x to $x-1$. By our concept of statistical equilibrium these two compound probabilities are equal.

(1) System Load Kw-1000	(2) Hours Duration Per Year	(3) Machines Scheduled	(4) Capacity Scheduled Kw-1000	(5) f(3)	(6) π_3	(7) $\pi_3 f(3)$	(8) f(4)	(9) π_4	(10) $\pi_4 f(4)$	(11) f(5)	(12) π_5	(13) $\pi_5 f(5)$	(14) Summation $\sum_{x=3}^{x=5} \pi_x f(x)$	(15) Hours Load Outage Expected (2) x (14)
195-200	5	10	240	.003334	59/120	.001639	.000225	210/210	.000225	.000011	252/252	.000011	.001875	.009375
190-195	7	9	225	.002505	28/84	.000835	.000169	126/126	.000169	.000008	126/126	.000008	.001012	.007084
185-190	10	9	225	.002505	10/84	.000298	.000169	126/126	.000169	.000008	126/126	.000008	.000475	.004750
180-185	13	9	225	.002505	1/84	.000030	.000169	123/126	.000165	.000008	126/126	.000008	.000203	.002639
175-180	18	9	225	.002505	0/84	.000000	.000169	111/126	.000149	.000008	126/126	.000008	.000157	.002826
170-175	31	8	205	.001812	0/56	.000000	.000109	56/70	.000087	.000005	56/56	.000005	.000092	.002852
165-170	36	8	205	.001812	0/56	.000000	.000109	35/70	.000055	.000005	56/56	.000005	.000060	.002160
160-165	50	8	205	.001812	0/56	.000000	.000109	14/70	.000022	.000005	56/56	.000005	.000027	.001350
155-160	65	8	205	.001812	0/56	.000000	.000109	3/70	.000005	.000005	56/56	.000005	.000010	.000650
150-155	80	7	185	.001252	0/35	.000000	.000066	0/35	.000000	.000002	21/21	.000002	.000002	.000160
145-150	95	7	185	.001252	0/35	.000000	.000066	0/35	.000000	.000002	21/21	.000002	.000002	.000190
													Total	.034036

f(x) = probability that x units will be simultaneously unavailable

π_x = probability that if x units are unavailable load outage will result

rm = .03

Approx. x Min. Per Year

Table 1

For convenience, letting $m = \frac{a}{T} =$ rate of failure per unit of service time, equation (1) may be written:

$$nm\, f(x-1) = \frac{x}{r} f(x) \quad \ldots\ldots\ldots (2)$$

The following hypothetical example may now be considered:

A system having a yearly peak load of 200,000 kw. has installed capacity of 270,000 kw. consisting of 12 generating units operating in parallel and connected by adequate buses and tie lines. The capacities of these units are assumed to be:

Nos. 1, 2, 3...30,000 kw. each
Nos. 4, 5, 6...25,000 kw. "
Nos. 7, 8, 9...20,000 kw. "
Nos. 10, 11, 12...15,000 kw. "

The larger machines will be considered the most efficient; the smaller ones the least efficient. The arbitrary requirement will be set up whereby the capacity of machines actually running equals, at all times possible, the load, plus at least 30,000 kw. Thus at the peak the required capacity will be at least 200,000 kw. + 30,000 kw. = 230,000 kw. By holding two of the least efficient machines, say Nos. 11 and 12, in reserve and running the remaining ten, a capacity of 240,000 kw. is obtained.

The first part of the problem comprises the determination of the probability of outage at the time of the peak, and then, knowing the number of hours of operation at peak load, computing the expected load outage.

With an installation of 12 machines there may exist any one of 13 conditions, viz., no units unavailable, one unit unavailable, two units unavailable, and so on to 12 units unavailable. The summation of the probabilities of these 13 conditions must equal unity, or certainty, since no other conditions respecting the availability of units may exist. Expressed mathematically:

$$f(0) + f(1) + f(2) + \ldots\ldots + f(12) = 1 \quad \ldots\ldots\ldots (3)$$

Since at peak load with no machines unavailable only the ten required are actually running, it may be assumed that failures which may occur will be confined to these ten. The general equation (2) may be written:

$$10\, m\, f(0) = \frac{1}{r} f(1), \text{ or } f(1) = \frac{10rm}{1} f(0) \quad \ldots\ldots\ldots (4)$$

Ten units will also be running whenever one or two units are unavailable. Therefore:

$$10\, m\, f(1) = \frac{2}{r} f(2), \text{ or } f(2) = \frac{10rm}{2} f(1) = \frac{10 \cdot 10 (rm)^2}{1 \cdot 2} f(0) \quad \ldots\ldots (5)$$

and

$$10\, m\, f(2) = \frac{3}{r} f(3), \text{ or } f(3) = \frac{10rm}{3} f(2) = \frac{10 \cdot 10 \cdot 10 (rm)^3}{1 \cdot 2 \cdot 3} f(0) \quad \ldots\ldots (6)$$

But whenever three units are unavailable only nine units can run, and:

$$9\, m\, f(3) = \frac{4}{r} f(4), \text{ or } f(4) = \frac{9rm}{4} f(3) = \frac{10 \cdot 10 \cdot 10 \cdot 9 (rm)^4}{1 \cdot 2 \cdot 3 \cdot 4} f(0)$$

And whenever four units are unavailable only eight units can run:

$$8\, m\, f(4) = \frac{5}{r} f(5), \text{ or } f(5) = \frac{8rm}{5} f(4) = \frac{10 \cdot 10 \cdot 10 \cdot 9 \cdot 8 (rm)^5}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5} f(0),$$

and so on to:

$$m\, f(11) = \frac{12}{r} f(12), \text{ or } f(12) = \frac{(10)^{10} 9! (rm)^{12}}{12!} f(0)$$

Substituting the expressions for f(1), f(2), etc. in terms of f(0) in equation (3) and solving for f(0):

$$f(0) = \frac{1}{1 + 10\,rm + \frac{(10)^2 (rm)^2}{2!} + \frac{(10)^3 (rm)^3}{3!} + \frac{(10)^3 9 (rm)^4}{4!} + \frac{(10)^3 \cdot 9 \cdot 8 (rm)^5}{5!} + \ldots}$$

The values of terms in the denominator for ordinary values of n and rm become so small relative to unity that the final ones may be omitted without introducing appreciable error.

Substituting the expression for f(o) in equation (4), the expression for f(1) becomes:

$$f(1) = \frac{10rm}{1 + 10\,rm + \frac{100(rm)^2}{2!} + \ldots}$$

Similarly from equation (5):

$$f(2) = \frac{\frac{100(rm)^2}{2!}}{1 + 10\,rm + \frac{100(rm)^2}{2!} + \ldots}$$

It will be observed that the expression rm is in reality the ratio of a unit's repair hours to its service hours, since m = the number of failures per unit of service time, and r = the average amount of repair time per failure. A reasonable value for this ratio is, for generating units, three percent.

Evaluating f(x) for various values of x and for rm = .03:

f(o) = .740 840
f(1) = .222 252
f(2) = .033 338
f(3) = .003 334
f(4) = .000 225
f(5) = .000 011

1.000 000

The summation f(6) + f(7) + ... + f(12) is negligible in this case, not appearing before the seventh place of decimals.

No interruption to service occurs when no units, or one unit, or two units, are out of service. When, however, three units are out a service interruption will occur provided the capacity of the three units exceeds 270,000 kw. — 200,000 kw. = 70,000 kw. Certain combinations of three units will amount to more than, and certain combinations less than, 70,000 kw. If it be assumed that the three units out of service are among machines No. 1 to No. 10 inclusive*, the probability of these three amounting to more than 70,000 kw. is easily calculable. Taking ten units three at a time, $120\ (\frac{10!}{7!\,3!})$ combinations may be formed. An inspection of these combinations reveals that 59 of the 120 amount to more than 70,000 kw. Since one combination can be assumed as likely to occur as another, the probability sought is $\frac{59}{120}$.

*It is possible, of course, that one of the original idle units which replaced the first failed unit, may itself fail and become the second failed unit. The chances are against this, and the assumption is justified, particularly as it errs on the side of conservatism.

Units Required for Peak Load	Probability of Load Outage at Peak = .001 rm*= .01	.02	.03	.04	.05	Probability of Load Outage at Peak = .0001 rm = .01	.02	.03	.04	.05
2	1	1	2	2	2	2	2	2	3	3
4	1	2	2	2	3	2	3	3	3	4
6	2	2	2	3	3	2	3	3	4	4
8	2	2	3	3	3	2	3	4	4	5
10	2	3	3	3	4	3	3	4	4	5
15	2	3	4	4	5	3	4	5	5	6
20	3	3	4	5	5	3	4	5	6	7
25	3	4	5	5	6	4	5	6	7	7
30	3	4	5	6	7	4	5	6	7	8
35	3	4	5	6	7	4	6	7	8	9
40	3	5	6	7	8	4	6	7	8	9
45	4	5	6	7	8	5	6	8	9	10
50	4	5	7	8	9	5	6	8	9	10
60	4	6	7	9	10	5	7	9	10	12
70	4	6	8	9	11	5	8	9	11	13
80	5	7	8	10	12	6	8	10	12	14
90	5	7	9	11	13	6	9	11	13	15
100	5	8	10	12	13	6	9	11	13	16

*rm = Ratio of repair hours to service hours.

Table II—Spare Units Required

When four units are unavailable an interruption is almost certain to occur, since any combination of four units among the first ten aggregates more than 70,000 kw. This is, of course, true also for the case of five or more units unavailable.

The total probability of load outage at the time of the peak is then:

$$0\,f(300) + 0\,f(1) + 0\,f(2) + \frac{59}{120}\,f(3) + f(4) + f(5) + \ldots + f(12)$$

Evaluated, this becomes:

$$(\frac{59}{120})\ (.003334) + .000225 + .000011 + \ldots = .001875$$

If the duration of the peak be five hours per year, the expectation of load loss at time of peak becomes (.001875) (5) = .009375 hours per year (approximately ½ minute per year).

Table I shows the summary of this calculation, together with probabilities and expectations similarly calculated for various periods below the actual peak. It will be noted that the outage expectations fall off rapidly as loads decrease in amount from the peak value. In fact, for the load durations assumed, it is not necessary to consider loads below around 75% of the peak, because, even though these lower loads obtain during the greatest part of the year, the probabilities of load outage shrink to insignificant proportions as, with lower loads, the available spare capacity increases. It should be remarked at this point that there may be critical situations at off-peak periods because of the effective reduction in capacity brought about by annual inspection and maintenance of generators and turbines and by scheduled condenser cleaning. For the duration of periods when, for example, two machines are undergoing regular prearranged maintenance, the system described would be considered as having only ten (instead of twelve) machines installed, and if it appeared necessary probabilities and expectations would be calculated on this basis.

The total expectation of load outage is, then, for the hypothetical system about two minutes per year. The significance of this value should be appreciated. It does not, of course, mean that every year the system will be interrupted for just two minutes. It means that if the system were operated under the

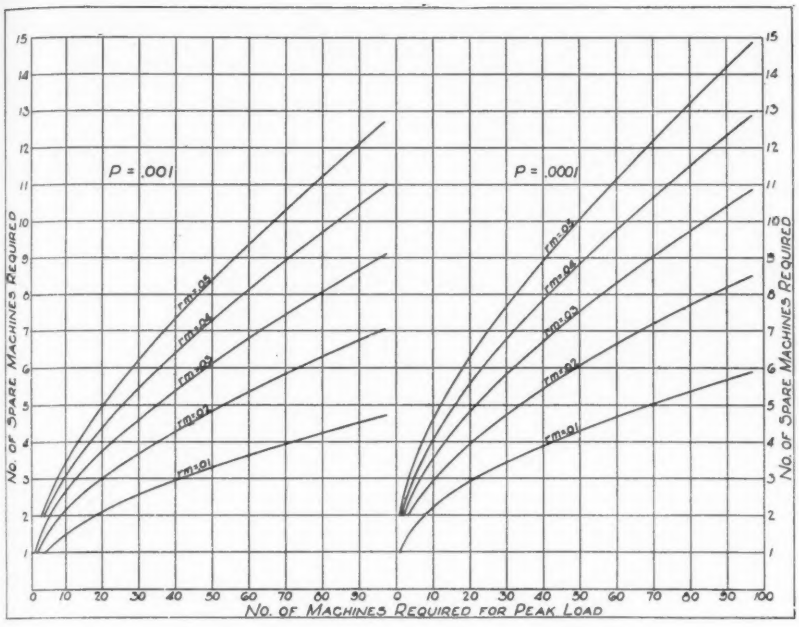


Fig. I *Fig. II*

same conditions for a great number of years, or if a great number of similar systems were operated concurrently, the *most likely* average amount of interruption per year per system would be two minutes. A single such system might operate for several years in succession without interruption, but in the long run its average interruption would approach the figure given.

An analysis such as presented above may be made for any actual system provided the basic data on failure rates, repair time, and load duration may be obtained. The effect on outage expectation may be worked out for a system on the basis of proposed increases or reductions of the number of generating units, or the calculation may be predicated on estimates of load increase or decrease.

Such analysis should be particularly useful in evaluating the gain in reliability to be obtained from the interconnection of two or more systems, or, if no increase in reliability is justified, it will make possible a computation of the exact amount of equipment which can be eliminated after an interconnection is effected.

In order roughly to indicate the savings in spare equipment possible by increasing the size of a generating system, Figures I and II are presented. The curves show, for several values of rm, and for various numbers of machines of uniform capacity required for peak conditions, the numbers of additional spare units which must be provided to obtain a probability of load outage at the time of the peak of .001 (Fig. I), or .0001 (Fig. II). The same information is presented in tabular form in Table II. For example, it is shown that a system in which 20 machines are required for load, and in which the ratio of repair time to service time is .03 for each unit, four machines are needed for a probability of outage at the time of the peak of .001. If two such systems be interconnected, with load for forty machines (assuming no load diversity) the same probability may be obtained with six spare machines, making possible the elimination of two machines. For a probability value of .0001 the smaller system requires five spare units and one of twice the capacity but seven spares, a saving after interconnection of three units. If considerable load diversity exists the saving in reserve capacity may be even greater.

While most of the discussion has been centered about the outage expectations of generating units, the general method is applicable to many other kinds of equipment such as boilers and auxiliary apparatus in generating stations; cables, transformers, oil circuit breakers, and regulators. This paper has been written not with the idea of covering the subject completely, but chiefly for the purpose of provoking interest in a very important field of investigation and pointing the way toward a more general and intensive application of that very powerful engineering tool—the theory of probability.

Canadian Electrical Association Notes

The Mid-Winter Conference of the Canadian Electrical Association was held at the Mount Royal Hotel, Montreal, on Feb. 5. Twenty-one different committees met during the day between the hours of 9:00 A.M. and 3:00 P.M., three of which adjourned when their allotted time had expired and reconvened later on in the day.

The section meetings planned for from 3:00 to 5:00 P.M. were exceptionally well attended and in one case lasted until 6:00 P.M.

There were over 150 delegates present during the day. The luncheon was attended by 120, and the dinner, at which Mr. G. Gordon Gale, vice-president and general manager, Gatineau Power Company, Ottawa, was the guest speaker, was attended by 135.

All committee meetings were exceptionally well attended and a great deal of constructive and valuable discussion was heard.

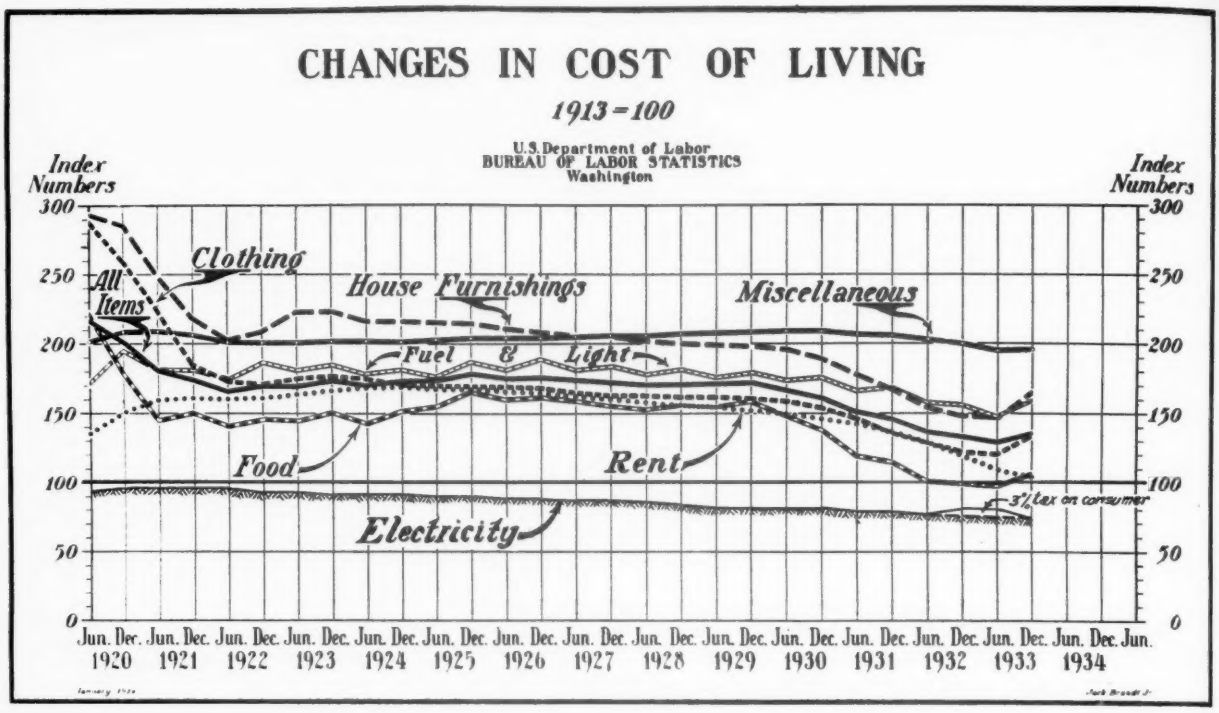
Mr. B. C. Fairchild, secretary of the association, writes that the meeting was such a success, from the point of attendance and work accomplished, that it is hoped it may become an annual event.

C.E.A. Offers Prizes to Members

The Canadian Electrical Association has announced a competition for member power companies Class "A" and all employees of Class "A" company members for the best papers presented on the subject of "Customer's Service" or "Customers' Relations." The First Prize will be three days at the 1934 Annual Convention of the C.E.A.—with all expenses paid, plus transportation up to an amount not exceeding $35.00 (if winner lives beyond 500 miles of Montreal, option of above or $75.00 cash); Second Prize—$25.00 cash; Third Prize—honorable mention. This contest closes April 30, 1934.

The C.E.A. also announced that special recognition and honorable mention will be given to the power company (Class "A") submitting the best idea it has carried out to improve customer's relations during the period April 1, 1934, to April 1, 1935. Papers on the above subject should be received at the Canadian Electrical Association office not later than April 30, 1935.

Further information on these prizes may be secured from Mr. B. C. Fairchild, 409 Power Building, Montreal, P. Q.



CHANGES IN COST OF LIVING

As Shown by U. S. Bureau of Labor Statistics

Table 1, reproduced from the report of the U. S. Bureau of Labor Statistics for December, 1933, gives the Index Numbers of the Cost of Living for Wage Earners and Low Salaried Workers, for the United States as a whole since 1913.

The classification "fuel and light" includes coal, gas and electricity. Of the group, coal constitutes the dominant factor and increases in the cost of anthracite have entirely masked the continued decline in the cost of electricity. For this reason, the Bureau has separated from the rest the price of domestic electric service. The relative decline of the average cost of the first 20 kilowatthours per month in 51 selected cities is shown by the Bureau's table (Table 2, on next page).

Relative changes, since January, 1920, are given on the chart, which is reproduced from the December bulletin of the U. S. Bureau of Labor Statistics, with the addition of the line for electricity, which has been plotted from the figures shown in Table 1.

TABLE 1.—INDEX NUMBERS OF COST OF LIVING FOR WAGE EARNERS AND LOW SALARIED WORKERS IN THE UNITED STATES, BY GROUPS OF ITEMS, 1913 TO DECEMBER, 1933

Date	Index numbers (1913 = 100)						
	Food	Clothing	Rent	Fuel and light	House-furnishing goods	Miscel-laneous	All Items
Average 1913	100.0	100.0	100.0	100.0	100.0	100.0	100.0
December 1914	105.0	101.0	100.0	101.0	104.0	103.0	103.0
December 1915	105.0	104.7	101.5	101.0	110.6	107.4	105.1
December 1916	126.0	120.0	102.3	108.4	127.8	113.3	118.3
December 1917	157.0	149.1	100.1	124.1	150.6	140.5	142.4
December 1918	187.0	205.3	109.2	147.9	213.6	165.8	174.4
June 1919	184.0	214.5	114.2	145.6	225.1	173.2	177.3
December 1919	197.0	268.7	125.3	156.8	263.5	190.2	199.3
June 1920	219.0	287.5	134.9	171.9	292.7	201.4	216.5
December 1920	178.0	258.5	151.1	194.9	285.4	208.2	200.4
May 1921	144.7	222.6	159.0	181.6	247.7	208.8	180.4
September 1921	153.1	192.1	160.0	180.9	224.7	207.8	177.3
December 1921	149.9	184.4	161.4	181.1	218.0	206.8	174.3
March 1922	138.7	175.5	160.9	175.8	206.2	203.3	166.9
June 1922	140.7	172.3	160.9	174.2	202.9	201.5	166.4
September 1922	139.7	171.3	161.1	183.6	202.9	201.1	166.3
December 1922	146.6	171.5	161.9	186.4	208.2	200.5	169.5
March 1923	141.9	174.4	162.4	186.2	217.6	200.3	168.8
June 1923	144.3	174.9	163.4	180.6	222.2	200.3	169.7
September 1923	149.3	176.5	164.4	181.3	222.4	201.1	172.1
December 1923	150.3	176.3	166.5	184.0	222.4	201.7	173.2
March 1924	143.7	175.8	167.0	182.2	221.3	201.1	170.4
June 1924	142.4	174.2	168.0	177.3	216.0	201.1	169.1
September 1924	146.8	172.3	168.0	179.1	214.9	201.1	170.6
December 1924	151.5	171.3	168.2	180.5	216.0	201.7	172.5
June 1925	155.0	170.6	167.4	176.5	214.3	202.7	173.5
December 1925	165.5	169.4	167.1	186.9	214.3	203.5	177.9
June 1926	159.7	168.2	165.4	180.7	210.4	203.3	174.8
December 1926	161.8	166.7	164.2	188.3	207.7	203.9	175.6
June 1927	158.5	164.9	162.1	180.8	205.2	204.5	173.4
December 1927	155.9	162.9	160.2	183.2	204.6	205.1	172.0
June 1928	152.6	162.6	157.6	177.2	201.1	205.5	170.0
December 1928	155.8	161.9	155.9	181.3	199.7	207.1	171.3
June 1929	154.8	161.3	153.7	175.2	198.5	207.3	170.2
December 1929	158.0	160.5	151.9	178.7	197.7	207.9	171.4
June 1930	147.9	158.9	149.6	172.8	195.7	208.5	166.6
December 1930	137.2	153.0	146.5	175.0	188.3	208.1	160.7
June 1931	118.3	146.0	142.0	165.4	177.0	206.6	150.3
December 1931	114.3	135.5	136.2	168.0	167.1	205.4	145.8
June 1932	100.1	127.8	127.8	157.1	153.4	202.1	135.7
December 1932	98.7	121.5	118.0	156.9	147.4	199.3	132.1
June 1933	96.7	119.8	108.8	148.4	147.7	194.5	128.3
December 1933	105.5	133.6	104.1	159.3	164.8	195.9	135.0

TABLE 2.—PER CENT OF DECREASE IN THE PRICE OF ELECTRICITY AT SPECIFIED PERIODS AS COMPARED WITH DECEMBER, 1913

Date	Percent of decrease from December 1913	Date	Percent of decrease from December 1913	Date	Percent of decrease from December 1913
December 1914	3.7	September 1922	6.2	June 1927	12.3
December 1915	6.2	December 1922	7.4	December 1927	12.3
December 1916	8.6	March 1923	7.4	June 1928	13.6
December 1917	11.1	June 1923	7.4	December 1928	14.8
December 1918	6.2	September 1923	8.6	June 1929	17.3
June 1919	6.2	December 1923	8.6	December 1929	17.3
December 1919	7.4	March 1924	8.6	June 1930	18.5
June 1920	7.4	June 1924	8.6	December 1930	18.5
December 1920	4.9	September 1924	8.6	June 1931	19.8
May 1921	4.9	December 1924	8.6	December 1931	19.8
September 1921	4.9	June 1925	9.9	June 1932	21.0
December 1921	4.9	December 1925	9.9	December 1932	19.8
March 1922	4.9	June 1926	11.1	June 1933	19.8
June 1922	6.2	December 1926	11.1	December 1933	24.7

Institute's Insurance Committee Holds Meeting in New York

The Insurance Committee of the Institute held its initial meeting on February 17th at the general offices of the Institute with Mr. G. H. Bourne, Chairman, presiding. Mr. Bourne said the committee would provide a center for the discussion and adjustment of insurance problems as they arise and for other functions that appear to be of practical benefit to the industry. The scope of this committee is: "To maintain contact and cooperate with insurance organizations on matters of common interest; to keep informed as to rates and forms of coverage for all kinds of insurance and current insurance practices, and to advise with and assist member companies in their insurance problems."

Mr. Bourne reported on certain observations which had been made recently by Mr. S. T. Maxwell, President of the Central Traction and Lighting Bureau, on the multiplicity of claims under the Electric Apparatus Clause. After discussion it was decided to send out a letter to member companies advising them of this situation and requesting data upon which an estimate could be based as to the merits of the case. It was decided to incorporate this questionnaire with the general questionnaire on the insurance experience of member companies.

A proposed form of questionnaire for insurance data to complete this information for the years 1930 to 1933, inclusive, was discussed. The last data procured was for 1929. After discussion, the draft of the questionnaire was modified in some respects, and the chairman was directed by the committee to arrange for the circulation of the revised draft by the Edison Electric Institute.

The committee decided that the members should continue to report to the Edison Electric Institute office the details of large or interesting fire losses in order that the Edison Electric Institute office may circulate these to all members of the Insurance Committee.

Mr. Bourne announced that no subcommittees would be appointed but that individual members of the committee would be detailed to sponsor certain continuing activities. The following assignments were announced:

F. H. DECKMAN as representative on the AGA Insurance Committee

H. P. HOOD as representative on the ATA Insurance Committee

I. M. CARPENTER to contact with the Towner Rating Bureau on Surety and Fidelity Insurance and Indemnity Bond matters

A. W. REID to contact with the National Bureau of Casualty and Surety Underwriters on Burglary and other forms of Casualty Insurance and also Boiler and Machinery insurance.

Reference was made to the booklet on "Fire Prevention and Fire Protection for Electric Transportation and Bus Companies, Electric Light and Power Companies and Manufacturer Gas Properties" which was prepared under the joint auspices of the Central Traction and Lighting Bureau and the Insurance Committees of the American Gas Assotion, American Transit Association and the Edison Electric Institute. Copies of this booklet have been distributed to the membership of the Institute and some are still available for those who wish additional copies.

National Electric Cookery Council Disbands

Announcement that the National Electric Cookery Council would cease operations was made by the electric range manufacturers at a meeting held at National Electrical Manufacturers Association headquarters in New York on March 8th.

The chief reason given for discontinuing the National Council was that the manufacturers are concentrating their efforts in working out plans with the Electric Home and Farm Authority in supplying low cost ranges for the T.V.A. territory.

According to the manufacturers the Federal program requires that electric ranges shall be provided at such a low price that sufficient funds could not be made available at this time to finance the extensive national advertising program planned and continue the operations of the National Council.

However, it is hoped that the manufacturers will be able to resume cooperative and extensive national promotion of electric cookery when the time is more propitious. In the meantime the substantial number of local cooperative groups now organized as Local Cookery Councils will undoubtedly continue to carry on local cooperative programs, pending the right opportunity to proceed with national advertising.

Pennsylvania Electric Association Activities

Following the dissolution of the N.E.L.A. in February of last year, the Pennsylvania Electric Association immediately took steps to continue its organization which had been functioning beneficially to member companies in Pennsylvania.

At a special meeting held in February, 1933, and also at the regular annual meeting held in Bedford Springs in September of the same year, the by-laws were amended so as to permit this association to function as an autonomous body.

As the Pennsylvania Electric Association is not officially assigned as a division or an integral part of any national association, the form of organization of sections and committees has been materially changed, although the four sections were retained. The association functions with the usual complement of officers, Executive committee, and members of the four sections, which latter, however, has been considerably reduced in personnel.

(Continued on page 94)

GENERAL CONSIDERATIONS IN THE USE OF NEUTRAL IMPEDANCE

A report prepared for the Joint Subcommittee on Development and Research

During the course of development of the electrical transmission systems, the relative advantages and disadvantages of operation with neutral isolated, solidly grounded, or grounded through various values of resistance or reactance, including a reactance tuned to approximate resonance with system capacitance, such as a Petersen coil system, have been studied and tried. The present report, which has been prepared for submission to the Joint Subcommittee on Development and Research, does not advocate any particular type of system, but simply analyzes the various factors involved and gives data to be used in a study of the type of system grounding for specific cases.

The interest of the Joint Subcommittee on Development and Research in this subject arises from the fact that one type of inductive coordination problem is concerned with the voltage induced in a communication circuit at times of faults-to-ground on paralleling power circuits. Since the magnitude of such an induced voltage is dependent, among other things, upon the magnitude of the ground return fault current, the limitation of the latter through the use of a neutral impedance may be important as a coordinative measure. The report has been written from this viewpoint, as the values of neutral impedance for such service are usually larger than those which would be selected primarily to meet the power operating conditions, such as improve stability, reduce voltage dips, or limit short circuit current duty. This does not mean that the two purposes to be served are incompatible, but it does require that the overall reactions which the use of neutral impedance may have be carefully considered.

In connection with a proposal to use neutral impedance in any specific inductive coordination problem, naturally the efficacy of the measure, regarded purely as a means of obtaining reductions in voltages induced in exposed communication circuits, is a fundamental point. A brief digest of the more important conclusions thus far reached in the study of this phase of the question is included in the report. For most practical problems, the extent of the reduction in ground fault current attainable by the use of neutral impedance can be calculated by well-known methods, and it is usually found that the reactions upon power system operation are the questions mainly involved in considering an application of neutral impedance.

The major part of the report has, therefore, been devoted to the technical factors affecting power system operation. Among such effects two which have seemed of fundamental significance are the possibility of power system overvoltages with the related questions of apparatus and line insulation and its protection, and the effects on, or modifications required in, the relaying system. Other considerations are those of system stability, continuity of service, system interconnections and damage to lines or equipment at the point of fault. The economics of the problem are touched on only briefly, although it is recognized that situations will arise where, aside from technical considerations, the costs involved will have an important bearing. The past and current practice of power systems with respect to the use of neutral impedance is also reviewed.

As indicated above, one of the most important subjects treated is the effect of neutral impedance on overvoltages appearing on sound phases during phase-to-ground disturbances, and the relation of this overvoltage to the protection, and insulation levels of lines and apparatus. A brief review is given of a study to determine the magnitude of these overvoltages. Part of the data has been secured from staged tests, but most of it is based on records from automatic oscillographs from operating systems. Measurements made on a 600-mile isolated neutral system covering a period of over two years, indicated a maximum voltage of 3.9 times the normal voltage to ground with 1.3 per cent of the records above three times normal. Records from surge recorders on the same system indicated a maximum of 5.4 times normal with 2.9 per cent of the records above five times normal. In analyzing the data from the surge recorders, figures characteristic of lightning and switching surges have been eliminated in determining the above magnitudes and percentages. Data from two systems operating with a neutral impedance and one equipped with Petersen coils indicated lower overvoltages than for the isolated neutral system mentioned above. An analysis of available data on the insulation of lines, together with the above data on overvoltages, indicated that the rated flashover voltage of the insulators will rarely be exceeded, even on systems with isolated neutral. A review of the insulation properties of cable indicates that overvoltages in the order of three times the nominal rating of the system may be safely withstood, for a short length of time.

This report has been recommended for issuance as an Engineering Report and when approved for release will be available for general distribution. It is expected that the release will be obtained within the next month.

The price of this report to member companies will be 60c—to non-members $1.50.

N.A.R.U.C. 1933 CONVENTION PROCEEDINGS

The Proceedings of the 45th annual convention of the National Association of Railway and Utilities Commissioners, held at Cincinnati, O., October 10-13, 1933, has now been published. Among the subjects discussed at the convention were:

Establishing rates by negotiation instead of by formal proceedings
Control of interstate motor vehicle operation
Depreciation
Holding Companies
Valuation

In this volume of more than five hundred pages will be found verbatim reports of the discussions above mentioned, together with the full text of all committee reports submitted as well as a number of addresses delivered by distinguished speakers, including Hon. Donald R. Richberg, Counsel to the National Recovery Administration; Hon. P. J. Farrell, Chairman of the Interstate Commerce Commission, and Hon. H. Lester Hooker, of Virginia, President of the National Association.

This book is published by the State Law Reporting Company, 30 Vesey Street, New York City, the official reporters and publishers of the National Association of Railroad and Utilities Commissioners. The cost is $6.00.

INDUSTRIAL HEATING NEWS

Contributed by Industrial Power & Heating Committee, E.E.I.

USE OF ELECTRIC HEAT IN THE MANUFACTURE OF MACARONI

Macaroni manufacturers have experienced considerable trouble with chilled dough, especially when starting their dough kneaders in the morning. The dough coming in contact with the cold casting of the kneading machine is chilled. By installing 5 kw in clamp-on heaters on the bottom of the kneading pan one of our customers has very easily and simply overcome this difficulty. The heaters are connected to slip rings on the vertical rotating shaft of the kneader and are operated through a thermostat set at 110 or 120 deg. Fahr. as desired for this operation. The results have been very satisfactory and will probably lead to equipping four other machines the same way.

Another application for the macaroni plant, and one which has replaced the steam heated jacket because of its ease of control and cleanliness, consists of heaters mounted on the head of macaroni extruders. Here again this insures proper temperature control of the dough at all times. Each cylinder is equipped with a 1 kw unit.

AIR HEATING

A large glass company and a steel company have installed space heaters for small offices and shops. The total load in these two installations is 10½ kw, which will consume approximately 5500 kwhr per year.

A water company has replaced an oil heater with a 3 kw space heater to maintain a temperature of 40 deg. in an isolated meter house. The electric space heater will be under thermostatic control to maintain a minimum temperature of 40 deg. It is expected that this installation will require 1600 kwhr per year.

ELECTRICALLY HEATING IMPREGNATING COMPOUND TANK

A prominent manufacturer of electrical products has installed 8 kw in immersion units in an impregnating compound tank. This unit replaces a gas-fired unit, and was installed to maintain accurate control of the temperature which regulates the consistency of the compound. This load is expected to consume 10,000 kwhr per year.

IMMERSION HEATERS IN THE MANUFACTURE OF FURNITURE POLISH

A maker of finishing materials for furniture manufacturers was recently confronted with a need for increasing the output of furniture polish. As a high melting point wax is used and only low pressure steam was available for heating, it was necessary to consider other means of heating that would be faster and yet free from hazard.

Four sheath wire units rated at 2000 watts each, were recommended and were cast in lead to fit in the bottom of a 120-gal. tank. This insured better heat distribution and eliminated any possibility of a higher temperature at any one point in the bottom where the wax is originally melted and held until solution is completed with the solvents.

A batch of this kind is completed in about 1½ hr. as compared with over 3 hr. when steam was applied to a tank of one-half the size equipped with one immersion unit of 1200 watts as booster.

ELECTRIC HEAT FOR MACHINE TOOLS

A machine shop specializing in hollow boring had difficulty in the morning pumping the cutting oil after an overnight shutdown.

A steel sheath immersion unit was installed in the sump tank to preheat the oil and facilitate pumping. The unit was bent in the shape of a half circle to fit around the pump intake pipe, the terminals extending over the side of the tank.

The customer was so well pleased with the trial installation that a similar unit was installed on the other large lathe.

USE OF IMMERSION HEATERS TO PREVENT FREEZING OF WATER

A manufacturer of electric welding equipment uses a large water storage tank in connection with the supply of water for their plant. During cold weather it has been necessary to drain the tank each night to prevent freezing and to fill it again in the morning. This practice is not only inconvenient but wastes a large amount of water. By installing a 6 kw immersion heater in the tank, it is unnecessary to drain the tank to prevent freezing. It is estimated that this unit will consume 1000 kwhr per year.

INVESTMENT OF LESS THAN $1,000 SAVES $2,000 A YEAR

High-pressure steam for heating four Bakelite moulding presses was formerly supplied by a large oil-fired steam boiler requiring a licensed attendant. At times this department operated three shifts a day, necessitating three boiler attendants. In the summer months the boiler was used solely for supplying steam for these moulding presses.

A study of the operations indicated that this electrical manufacturer could save $2,000 a year by installing separate electric steam generators for each press. On the basis of the power company's study, one electric boiler was built and installed. Several months of operation bore out the estimates, and disclosed in addition that the more closely controlled pressure of the electric steam generator results in moulded parts of more uniform quality. Three additional boilers have been installed, the large oil-fired boiler has been completely shut down, and net savings at the rate of $2,000 a year are being achieved. Four electric boilers of 10 kw each are being used.

ELECTRIC HEATING REPLACES EXHAUST STEAM FROM AN ISOLATED PLANT FOR PROCESS HEATING

A large envelope manufacturer formerly used exhaust steam from his isolated power plant for drying the gum on envelope flaps and for heating the platens of a vulcanizing press used for vulcanizing rubber mats for printing.

Experimentation with heating units on the individual envelope machines and a general study of their power situation indicated economies through the use of electric heat and the purchase of their plant power requirements.

When steam was used for drying, a large blower was in operation at all times and the steam usage was more or less constant, irrespective of the number of machines in use. Electric heat on each machine permitted greater flexibility and economy as heat was used only when a machine was in operation.

Forty-five kw of heating units are installed on 71 machines for drying the envelope flaps, and a 22½-kw electric steam boiler now supplies 60-lb. pressure steam to the vulcanizing press.

POWER SALES ITEMS

AIR CONDITIONING

"Modern Lighting and Air Conditioning," by A. L. Powell. Electrical World, Feb. 19, 1934, p. 225. McGraw-Hill Publishing Company, Inc., 330 West Forty-second Street, New York City.

DIESEL ENGINES

"A Brief History of the 1933 Diesel." Editorial. Diesel Power, January, 1934, p. 10. Business Journals, Inc., Publishers, 192 Lexington Avenue, New York City.

The article contains a discussion of the fuel oil research work during 1933. New designs are discussed showing that the notable development during the year was in high-speed engines, both of the two-cycle and four-cycle airless injection types. Outstanding installations are mentioned and plans for the coming year outlined.

"Diesel Engines Reduce Power Costs in Breweries," by Edgar J. Kates, Consulting Engineer, New York. Diesel Power, February, 1934, pp. 58-59. Business Journals, Inc., Publishers, 192 Lexington Avenue New York City.

Due to the non-coincident demands for process steam and electric power the author suggests the use of coal-fired boilers to produce steam and Diesel engines to furnish power. No real consideration is given to the economies of purchased electric power or the possibilities of using back pressure turbo-generators with a purchased electric power interconnection.

"The Pelican Ice Company Dieselizes Its Ice Plant," by G. A. Palmer. Diesel Power, February, 1934, pp. 52-55. Business Journals, Inc., Publishers, 192 Lexington Avenue, New York City.

This article describes the power plant at the above company, located in New Orleans, which company first used steam engines, then purchased power, and finally Diesel engines. Operating costs are given for the year 1932.

Breweries and Ice Plant Number, Diesel Power, February, 1934. Published by Business Journals, Inc., 192 Lexington Avenue, New York City.

This issue is devoted almost entirely to the use of Diesel engines in plants requiring refrigeration, such as ice plants, breweries, milk plants, etc. Several plants are described as regards the equipment installed. Very few operating costs are given.

DIESEL ENGINES

"Crankless Opposed Piston Diesel Engine." Power, February, 1934, pp. 85 and 111. McGraw Hill Publishing Company, Inc., 330 West 42nd Street, New York City.

This article describes the design of the new simplified crankless Diesel engine, together with mentioning several other Diesel exhibitions at the Motor Boat Show.

ELECTRONIC CONTROL

"Factors Affecting Adoption of Electronic Control in Industry," by C. Stansbury. Electrical World, Jan. 27, 1934, Volume 103, No. 4, pp. 154-158. McGraw-Hill Publishing Company, Inc., 330 West Forty-second Street, New York City.

ELECTRIC INDUSTRY DEVELOPMENTS

"Electrical Developments in Industry." Electrical World, Jan. 6, 1934, pp. 51-56. McGraw-Hill Publishing Company, Inc., 330 West Forty-second Street, New York City.

GAS-DIESELS

"High Speed Convertible Gas-Diesels," by W. M. Kaufman. Power, February, 1934, pp. 70-72. McGraw Hill Publishing Company, Inc., 330 West 42nd Street, New York City.

An interesting article discussing the development, design and economy of convertible gas-Diesel engines which are increasing in popularity.

INDUSTRIAL ELECTRIFICATION

"Revised Layout Improves Condition in Woolen Mill," by Francis A. Westbrook. Electrical World, Jan. 13, 1934, p. 85. McGraw-Hill Publishing Company, Inc., 330 West Forty-second Street, New York City.

"Today's Equipment Eliminates Hazards of Explosive Atmospheres," by George H. Hall. Electrical World, Feb. 10, 1934, Volume 103, No. 6, pp. 228-232. McGraw-Hill Publishing Company, Inc., 330 West Forty-second Street, New York City.

"Electrical Developments in Industry." Electrical World, Jan. 6, 1934, Volume 103, No. 1, pp. 51-56. McGraw-Hill Publishing Company, Inc., 330 West Forty-second Street, New York City.

INDUSTRIAL POWER

"Add Turbines to Boiler Plant; Will Pay Out in 3½ Years." Power, March, 1934, pp. 115-117. McGraw Hill Publishing Company, Inc., 330 West 42nd Street, New York City.

American Chicle Company installed a 1500-kva., steam-turbine-driven, 4-unit power-generating plant and cooling-tower capacity for one 550-hp. unit and its refrigerating plant. Savings in operating cost will return total equipment investment and consulting engineer's fee in about 3.5 years.

MACHINE TOOLS

"Wiring of Machine Tools Needs Attention," by D. K. Frost, Electrical World, February 3, 1934, Volume 103, No. 5, pp. 195-197. McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York City.

MOTORS

"New Designs Extend Synchronous Motor Uses," by Charles C. Shutt, Industrial Power Engineer, Westinghouse Electric & Manufacturing Company. Power, February, 1934, pp. 86-87. McGraw-Hill Publishing Company, Inc., 330 West Forty-second Street, New York City.

The newly developed high-speed motor combines the starting characteristics of a wound-rotor induction motor with the operating advantages of a synchronous motor. The application of synchronous motors is extended providing an attractive means of improving power factor for both industrials and utilities.

"Power by Electric Motor—Part 9—Motors and Control for Cotton Seel Oil Mills," by H. M. French, General Electric Company. Southern Power Journal, February, 1934, pp. 49-51. W. R. C. Smith Publishing Company, Grant Building, Atlanta, Ga.

Review of typical forms of motor drives in cotton seed oil mills with cost data on motors and controls and summary of the advantages of electric drive in this industry.

POWER COSTS

"What Electricity Costs." Editorial. Power, February, 1934, pp. 68-69. McGraw-Hill Publishing Company, Inc., 330 West Forty-second Street, New York City.

The article contains an interesting tabulation of power costs for various classes of customers in all sections of the United States.

RURAL ELECTRIFICATION

"Gradual Rural Electrification," by H. P. Liversidge. Electrical World, Jan. 27, 1934, pp. 149-151. McGraw-Hill Publishing Company, Inc., 330 West Forty-second Street, New York City.

Vast market for service awaits sound development. Urban and rural interests should not be separated.

Pennsylvania Association

(*Continued from page* 91)

It was also decided that instead of forming standing committees under the sections, subcommittees should be appointed if and when any study or survey of a particular subject was deemed necessary, and that subcommittee would be assigned to one of the four sections and would automatically dissolve upon the completion of the work assigned to it.

While there was some delay in the appointment of the personnel of the four sections, members of which were selected because of their particular fitness for the phase of the industry coming within the scope of the section, they are now fully organized and functioning, and a number of meetings have been held.

One of the most important recent meetings was held under the direction of the Sales Section, in Pittsburgh, on Feb. 27, 1934, at which time a sales conference was conducted. Amongst other matters of interest was an address by a utility representative from the Southern District of the United States affected by the Tennessee Valley operations.

A representative of the industry also spoke on utility taxation, and other speakers and discussions were heard on "Marketing Methods Required for Load Building", and "Production of Appliances and Their Price Level for Future Load Building."

Annual Engineering Conference Missouri Valley Electric Association

The sixth annual conference of the Engineering Group of the Missouri Valley Electric Association was held at the President Hotel in Kansas City on March 1 and 2.

The conference opened with a general meeting presided over by F. E. Smith, who gave a general discussion on several of the major engineering problems concerning the Association.

Mr. Roy Page, President of the Missouri Valley Electric Association, addressed the general session on economic problems involved in the operation of electric light and power companies.

A dinner meeting was held on the evening of March 1 which was presided over by Mr. Smith and at which Professor Will A. Irwin, of Washburn College, Topeka, Kansas, discussed national economic problems. Frank R. Innes, Western Editor of the *Electrical World*, gave a short address at this meeting in which he discussed some of the erroneous views commonly held concerning the cost of electric power generated by hydro electric plants.

A one-day meeting of the several committees was held with papers and discussions being given as outlined below:

The *Accident Prevention Committee's* program, R. C. Geppert, Chairman, included the subjects of maintaining interest in safety, methods of discipline, safe practices in the performance of jobs, general practice in handling hot line tools with rubber gloves, tool inspection, and the foreman's responsibility for proper selection and training of men.

The *Electrical Apparatus Committee*, D. D. Clarke, Chairman, discussed utilization, including the cost of range wiring and adequate low cost wiring for buildings, demonstration of modern lighting practice, problems in the utilization equipment peculiar to air conditioning and refrigerating apparatus; protective problems, including the fire hazard in constant current transformers, distant type relays for transmission lines, protection of neutral grounded transformers against ground faults, over-all testing of relays, melting point of fuse links and immediate reclosure of oil switches and fuses; operating problems involving the operation and maintenance of regulators and charging of storage batteries; new apparatus problems, including a discussion on step regulators, insulation coordination with sub-station of lines, and modernizing transformers.

The subjects discussed by the *Foreign Systems Coordination Committee*, C. V. Waddington, Chairman, were inductive coordination from the standpoint of independent telephone systems, communication service for power lines, maintaining contacts with communication companies relative to development and coordination of plant facilities, relaying ground faults, joint use contracts and the location and elimination of radio interference.

The *Meter Committee*, H. A. Howery, Chairman, discussed meter jewels and bearings, compensating metering, current diversion, new sequence metering, the manufacture of meter test blocks. A joint session with the Electrical Apparatus Committee was held and the cost of range wiring installations was discussed.

The subjects discussed by the *Overhead Systems Committee*, Ivan Buys, Chairman, were voltage regulation on rural lines, survey of uses and limitation of mechanical splices and taps, economy in maintenance versus service reliability of transmission and distribution lines, wood insulation of transmission lines, and bare wire construction and operation for distribution.

RECENT PUBLICATIONS

A number of reports, prepared by committees of the National Electric Light Association prior to their dissolution, were transferred to the Edison Electric Institute by the Liquidating Committee of the N.E.L.A. Because of the value to the industry of the material contained in the reports they have been published by the Institute and may be purchased at the following prices:

Pub. No.	*Foreign Systems Coordination Committee*	*Price to Members*	*Price to Non-Members*	*Price to Foreign Countries*
A13	Power System Wave Shape	$0.20	$0.50	$0.60
	Hydraulic Power Committee			
A18	Economic Design of Hydro-Electric Plants	.20	.50	.60
A19	Hydraulic Governors	.20	.50	.60
	Power Systems Engineering Committee			
A16	Load and Revenue Forecasting	.30	.75	.85
A11	Load Area Development	.30	.75	.85
	Prime Movers Committee			
A4	Burning of Liquid and Gaseous Fuels	.30	.75	.85
A5	Power Station Chemistry	.40	1.00	1.10
A6	Pulverized Fuel	.75	1.85	2.00
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A10	Cable Operation—1932	.45	1.15	1.25
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A12	Fault Locating Methods Used on Underground Cable Systems	.40	1.00	1.10
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	Accounting			
A1	The Electric Light and Power Industry, 1932	.30	.75	.85

The prices include mailing charges. Member prices apply to employees of company members of the Institute. Please send money order or check with order. Orders should be addressed to—

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The Institute has in stock a limited number of reports prepared by Engineering Committees of the former National Electric Light Association during the past several years. These reports may be ordered from the Institute from the price lists issued by the N.E.L.A., or a new list will be forwarded upon request.

The *Power Systems Engineering Committee*, C. W. Minard, Chairman, considered methods of allocating investment used to service different classes of customers, Diesel engine competition, economics of combined industrial and utility power plants, economics of service improvement, forecasting load growth for small companies, and the effect of new uses of electrical energy on economic methods of distribution.

The subject discussed by the *Prime Movers Committee*, John M. Drabelle, Chairman, included operation of evaporators, heaters and de-aireators, the use of natural gas as boiler fuel dealing with economic advances and designs for converting coal fired boilers to gas operation, metering natural gas for power station use, and the selection and preparation of coal samples.

The *Underground Systems Committee*, H. B. Hoffhaus, Chairman, discussed maintenance problems, cable splicing, electrolysis, present day trends in underground distribution, networks, and development in the use of non-leaded cables.

In addition to the above mentioned committees and programs, the Power Sales Group of the Missouri Valley Electric Association, with F. A. Graham, Chairman, held a one-day meeting at which the following subjects were discussed: opportunities for new load, retaining present load, and the meeting of isolated plant competition.

Insurance Rates Lowered

(*Continued from page 79*)

the policy. The first is called the "Use and Occupancy" endorsement which provides for a daily indemnity for each day during which the production of a plant is prevented by an accident, and the second called the "Outage" endorsement which provides for an hourly indemnity for each hour during which the functions of a specified machine are prevented by an accident.

The Engineering Inspection service which the insurance companies furnish under these forms of coverage has been materially expanded and improved in recent years and is an important part of the insurance.

The Insurance Committee is glad to say that its relations with the National Bureau of Casualty & Surety Underwriters have been most pleasant and that it has received the willing cooperation and consideration of the Bureau on matters having to do with machinery insurance for public utilities.

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CONVENTIONS AND MEETINGS

MARCH

1-2 Missouri Valley Electrical Association, Engineering Group, President Hotel, Kansas City, Mo.
6-7 Oklahoma Utilities Association, Mayo Hotel, Tulsa, Okla.
7 American Society for Testing Materials, Washington, D. C.
13 Rural Sales Committee, Edgewater Beach Hotel, Chicago, Ill.
14-15 Sales Committee Conference, Edgewater Beach Hotel, Chicago, Ill.
26-27 Transmission and Distribution Committee, Hotel Cleveland, Cleveland, Ohio.
27-28 Power Generation Committee, Hotel Cleveland, Cleveland, Ohio.
28-29 Electrical Equipment Committee, Hotel Cleveland, Cleveland, Ohio.

APRIL

19-20 Missouri Association of Public Utilities, The Elms Hotel, Excelsior Springs, Mo.
26-28 Electrochemical Society, Asheville, N. C.

MAY

1-4 Chamber of Commerce of the United States of America, Washington, D. C.
14-18 National Fire Protection Association, Haddon Hall, Atlantic City, N. J.
16-18 American Institute of Electrical Engineers, Worcester, Mass.
24 National Board of Fire Underwriters, Waldorf-Astoria Hotel, New York, N. Y.

JUNE

4-7 Annual Convention, EDISON ELECTRIC INSTITUTE, Traymore Hotel, Atlantic City, N. J.
12-14 Signal Section of the American Railway Association, Hotel Stevens, Chicago, Ill.
18-21 National Association of Purchasing Agents, Hotel Cleveland, Cleveland, Ohio.
25-29 American Institute of Electrical Engineers, The Homestead, Hot Springs, Va.

SEPTEMBER

24-28 American Transit Association, Cleveland Public Auditorium, Cleveland, Ohio.

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